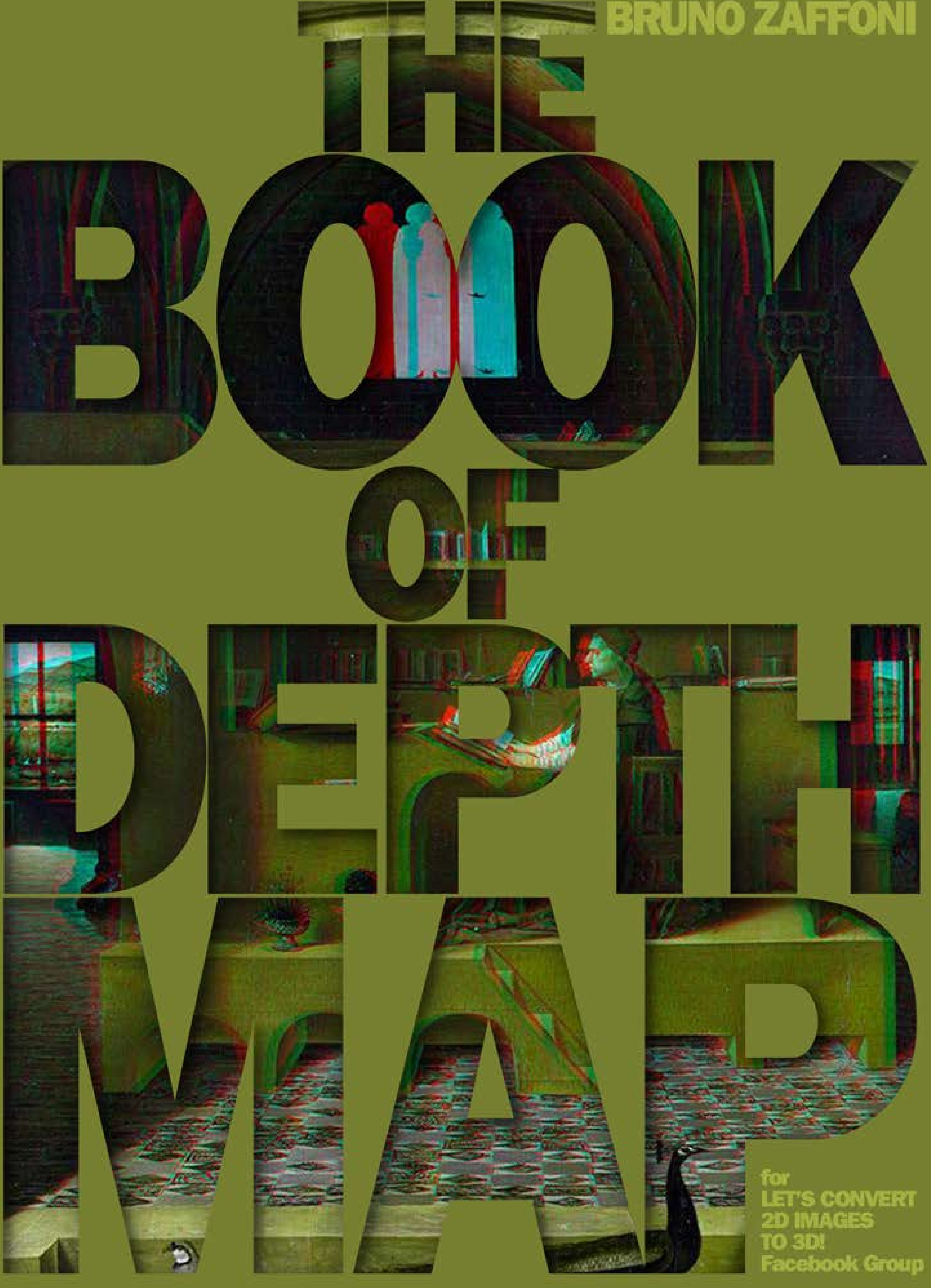
BRUNO ZAFFONI

THE BOOK OF DEPTH MAP



for
LET'S CONVERT
2D IMAGES
TO 3D!
Facebook Group

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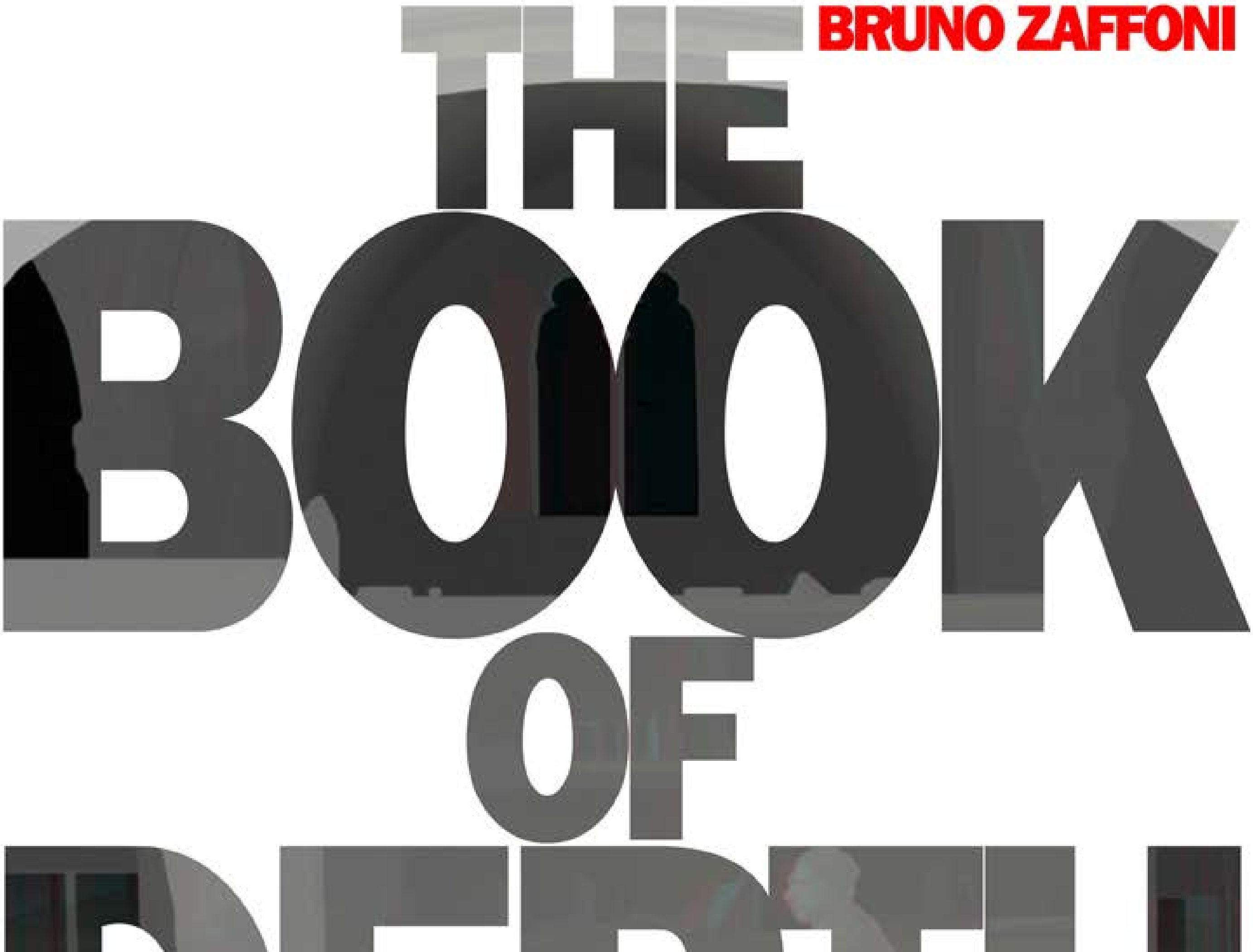

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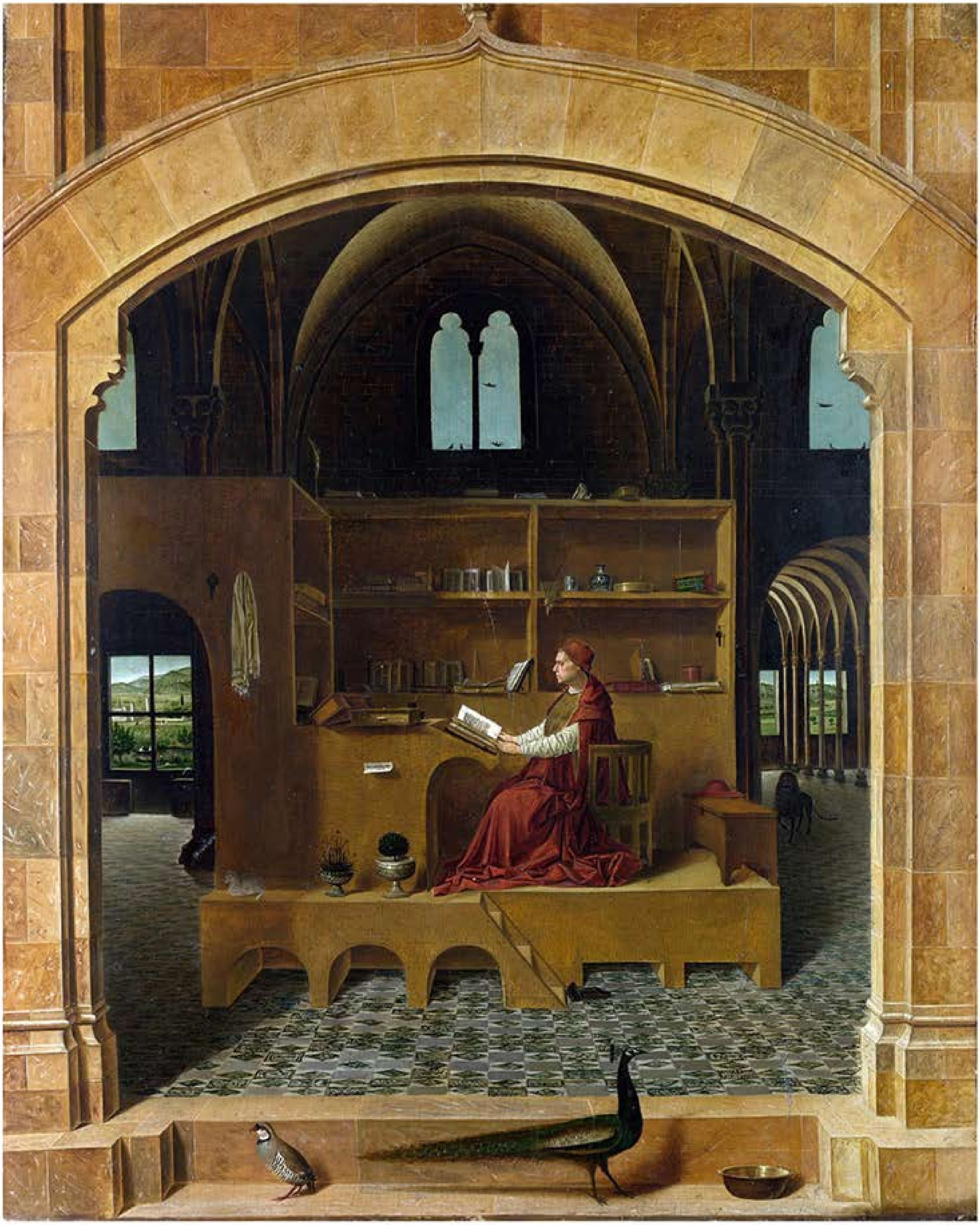


INTRODUCTION

As a former graphic designer (mostly bespectacled) I have always been interested in visual perception. This is why I have always wondered why people passively accept to see a photo, a picture, the television as flat as a cartoons character squashed on the ground after a fall. Like the Cyclops Polyphemus, we look only with one eye. And we don't notice.

I saw the first 3D conversions a few years ago on Flickr, where I posted my mediocre travel photos taken with the system which I later discovered was called cha cha. A new world was opening up: images that seemed destined for flatness came out of the monitor and came to life.

Thanks to masters like Ferry Zijlmans, Dan Jacob, Shahrokh Dabiri and others, I began to make imperfect conversions, but someone was already asking how I did them. Then I got bored, until recently Ted Whitten invited me to the Let's convert images from 2D to 3D group!
I started again with new conversions and to frequent Facebook, which I had not frequented for years, discovering Facebook 3D, still imperfect but fun and promising. Without false modesty, I think I have improved a lot in these few months, deliberately facing the most disparate subjects, as if it were a continuous challenge.

For this reason, as a tribute to my Masters, I make available to those who want to learn my recent experience, telling my working method which is based above all on depth maps. I will do it a little at a time, like an episode show, because becoming a teacher is tiring for a student.

Thanks to those I mentioned, especially to Ferry, who with his tutorial made me want again. And I apologize for my English, but if you don't understand it is the fault of the Google translator.

WHAT IS NEEDED

Of course any computer, preferably with at least 8 Giga of RAM, with the usual peripherals, to which I would add a graphics tablet. It is not necessary but it is cheap and speeds up the work.

Any graphic program, as long as it work with the levels. The various Paint Shops, Gimp, etc. are well. I use Photoshop (PSH) and this is what I will refer to in the tutorial.

A 3D rendering program. StereoPhotoMaker (SPM) advice from friend Masuji Suto, which can be downloaded for free from the web and is indispensable for any stereoscopic lover.

Optional, the ability to view stereo pairs, either with cross view or with parallel view. If you don't have it you can use a viewer like Loreo Pixi. Alternatively, the classic rossoblu glasses to see the anaglyphs.

A Facebook account, if you want to take advantage of the 3D of FB, a parastereoscopic algorithm still imperfect but which promises well. I will also discuss this.

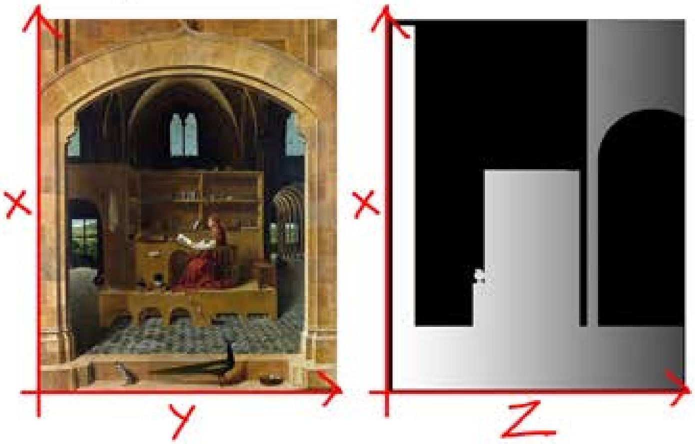
Time and patience. Compared to other systems, depth maps are faster, a conversion rarely takes me more than four hours, but it is better if you are retired like me.

That's all.

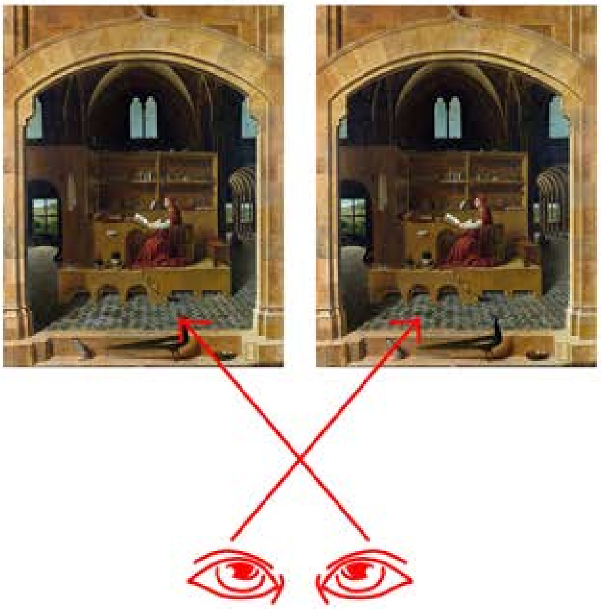
TWO WORDS ON DEPTH MAPS

What is a depth map? If you are reading this tutorial you probably already know it, but a review is always convenient.

In computergraphics a depth map is a drawing in 256 shades of gray that contains information on the distance of one or more elements from a hypothetical observer along the Z axis, that is the depth.



Since the dimensional information contained in a two-dimensional image is only base X and height Y, if it is processed via software together with the map, it returns, through the displacement of the pixels, two different images that correspond to the binocular vision.



LET'S BEGIN

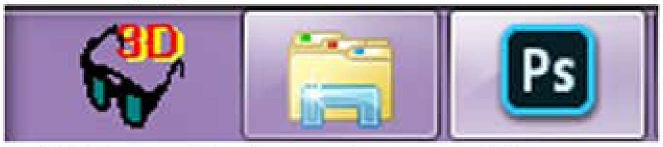
To convert a 3D image you need ... a flat image. It can be a photo, a drawing, a painting, everything is fine as long as you see its depth, even if still unexpressed.

There are artists who think in 3D and others do not, there are images in which the difference between 2 and 3D is small and others who earn a lot with stereoscopy. Choose well.

For this tutorial I chose St. Jerome in his study by Antonello da Messina, a painting on wood from 1475, preserved in the National Gallery in London. Not because it has particular three-dimensional characteristics, but because it presents a fair range of problems.

PRELIMINARY

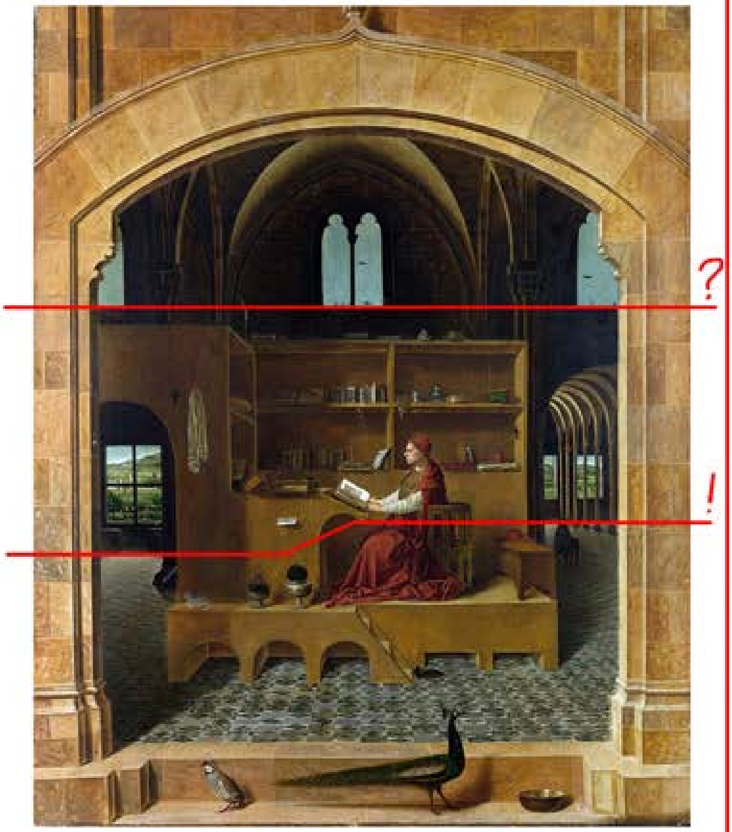
Open PSH and simultaneously SPM. It is important that they both appear in the bottom bar, because you will have to jump often between programs.



In PSH, open the chosen image and, if necessary, resize it. I prefer to work with images between 1200 and 2000 pixels high.
Save the image in a new folder (example: Antonello) as a .PSD file (which maintains the layers) and as a .JPG file with the same name (example: Antonello.psd and Antonello.jpg).
Save it again as a .JPG file, adding the ending _depth (example: Antonello_depth.jpg).

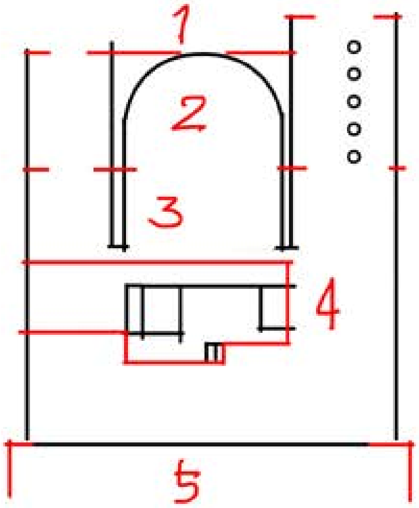
ANALYSIS

Let's take time to study the image well, because a bad start can compromise the entire conversion process, and it is not pleasant to notice it in advanced work.



We would realize that Antonello's painting is at least ambiguous, almost an involuntary Escher ante litteram: the back wall, with the two windows at the bottom overlooking the landscape, is misaligned. This is possible if there was a step hidden behind the library block, but in this case a trace of it should also appear in the foreground.
In addition, the three mullioned windows at the top seem aligned and at the same distance from the observer, but it is evident, from the portico on the right, that the central one is set back from the lateral ones.

But if Antonello has cheated, we can do it too, simplifying things a little. First of all, let's think of a mental map (this one I have drawn only by way of example), separating the various elements based on their distance from the viewer.



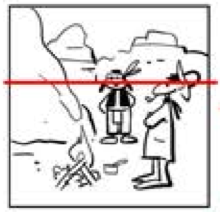
We will process them one at a time, excluding 1 which is the outside which, being distant, does not need any intervention;
2-3, from the back wall with the central mullioned window to the arches, includes the central vault and the colonnade and ends with the side windows;
3-4, the arches;
4, the platform block with a saint, bench, desk, library and various wares.
5, the close step, the arched portal and the birds.

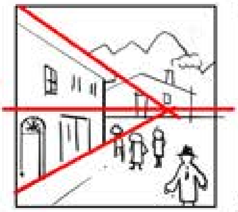
This is the beauty of making conversions: immersing yourself in a work not only with the eyes, but also with the brain. Understanding the author's intentions, his cunning and his mistakes, in a full immersion that will last a few hours.

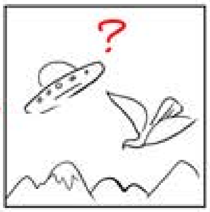
THE HORIZON

We know that beyond a certain distance the parallax is reset and stereoscopic vision no longer works. The first step is to define, in our image, what that distance is. Important choice, because the whole conversion structure depends on it.

We can make it coincide with the horizon line, whose position is often clear, because the perspective lines converge at a specific point, or it can be based on the observer's height, the relative size of the elements, the blur, etc. In these cases our visual experience helps us calculate the distances between the elements of an image. But sometimes there is no reference, think of two objects of which we do not know the dimensions portrayed in the sky.

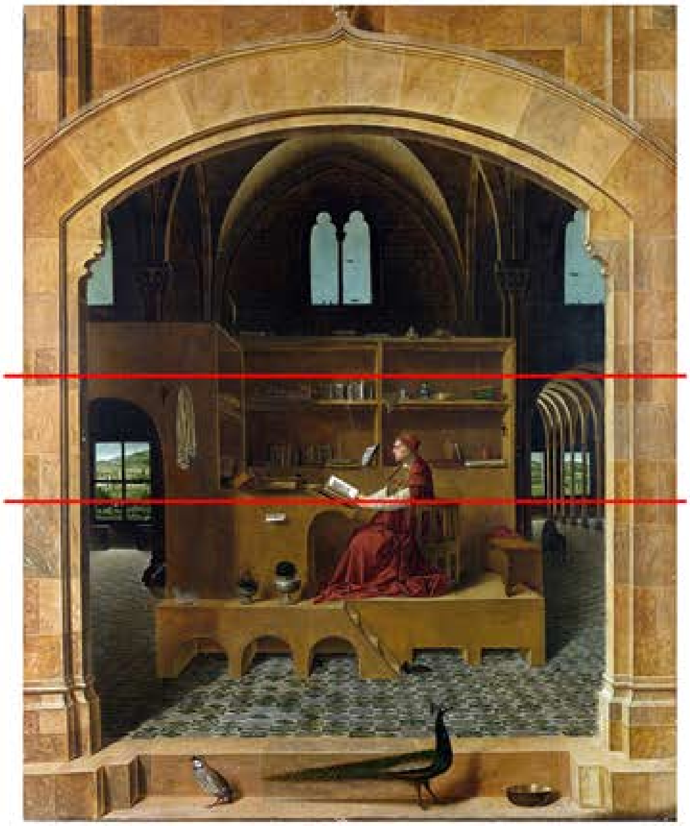






In our case, I want the external landscape to come off the back wall and appear "outside" the bottom windows.

Our perception of depth is limited by the 6 or 7 cm distance between the pupils. If we "really" looked at the scene of the painting, perhaps we would not even notice that the landscape is "outside" the window. Only if we had the most distant eyes could we see it "outside", as in a hyperstereo photo. In a depth map we can define the height of the horizon, according to the desired depth. Raising the line is like widening your eyes.



Look at the image: the bottom line is the actual horizon, calculated based on your height, the top one is the one I chose, for a deeper result.

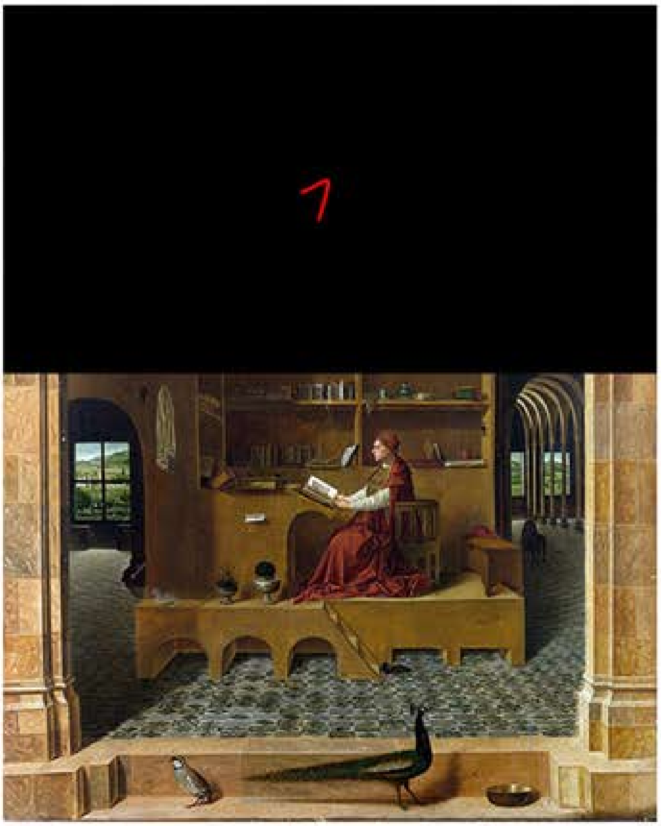
START

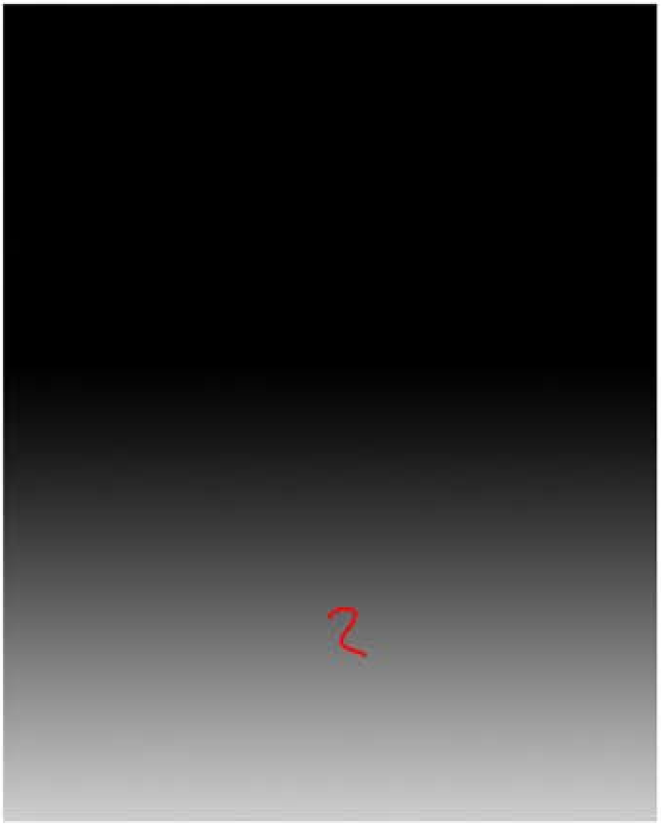
Enough talk, let's move on to PSH.

Create a new layer (I assume that you have at least the basics of your graphic program).

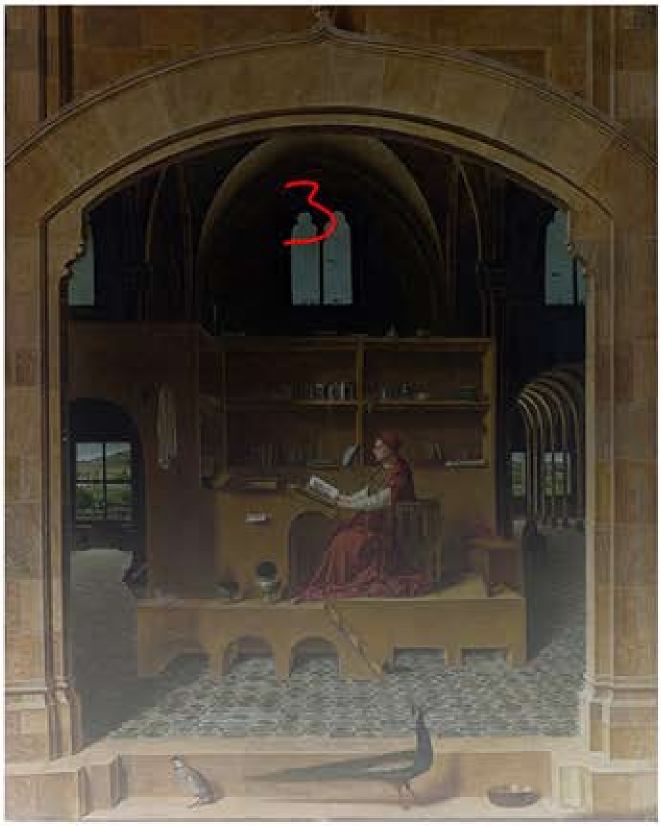
1. Select the area above the horizon and fill it with black. The black area has no depth information and when you render with SPM it will remain unchanged.

2. Invert the selection and fill the bottom part with a gradient from black 100 to black 20. I advise you not to use white at this stage because if you had to make changes during the course of work you would find yourself short of shades.



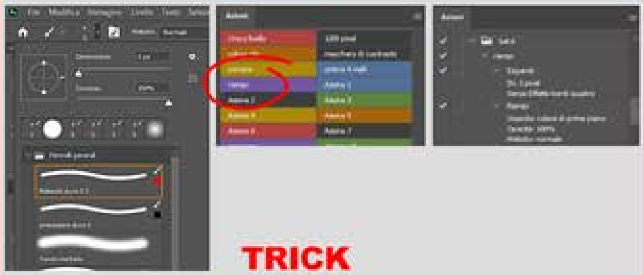


Note: A map can have light gray shades to indicate proximity and dark shades for distance, or vice versa. This is indifferent, when rendering in SPM you set what you want.



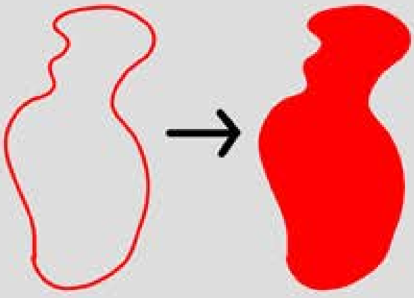
3. Now duplicate the base image and drag the layer up in the layers palette.
Set transparency to 50%.

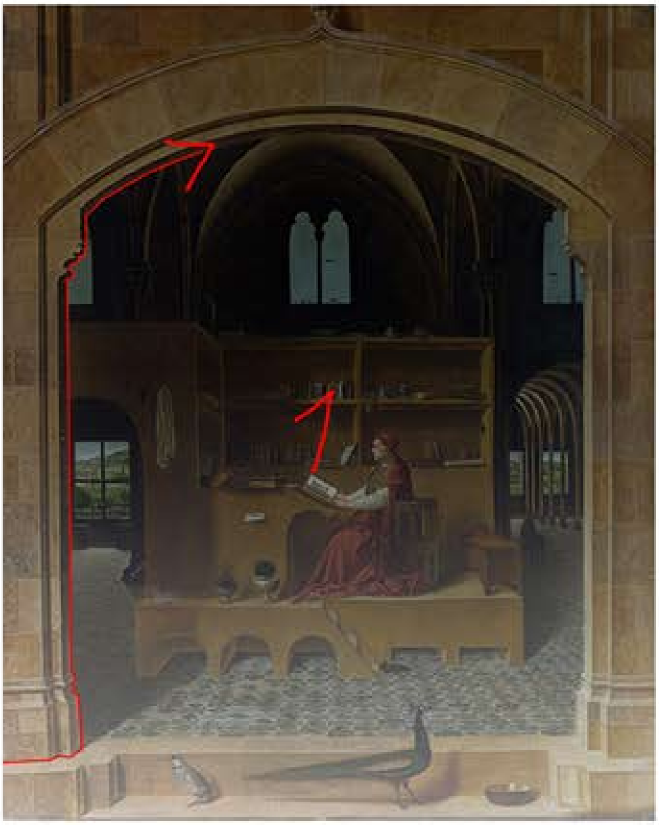
Now you're ready for the map drawing.



TRICK

In the meantime I saved two frequently used tools: a red (or magenta, if you prefer) brush with a diameter of 5 pixels and a Photoshop "Fill" action, which is used to fill selections with the main color and an abundance of 2 pixels. I don't know the English terms used by Photoshop, sorry. However the result is this:

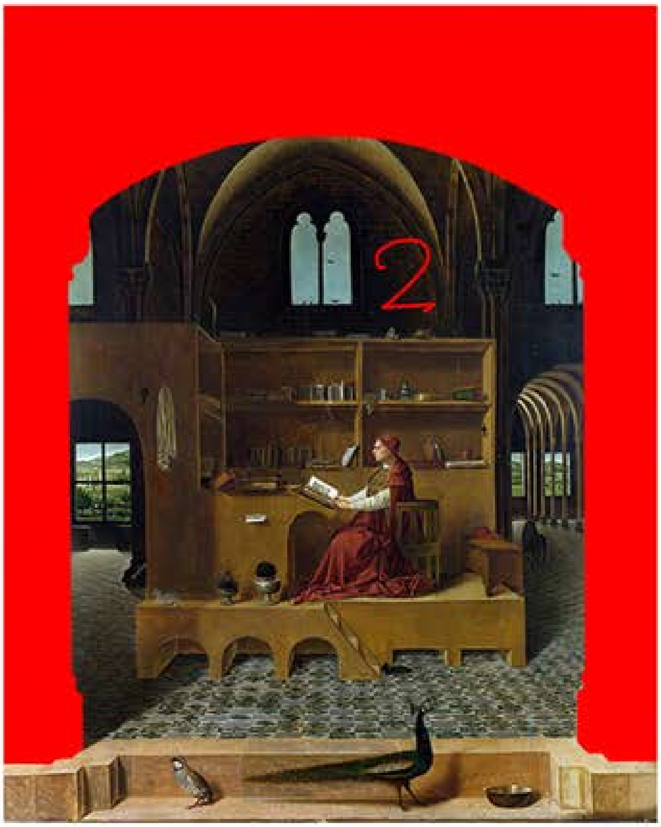


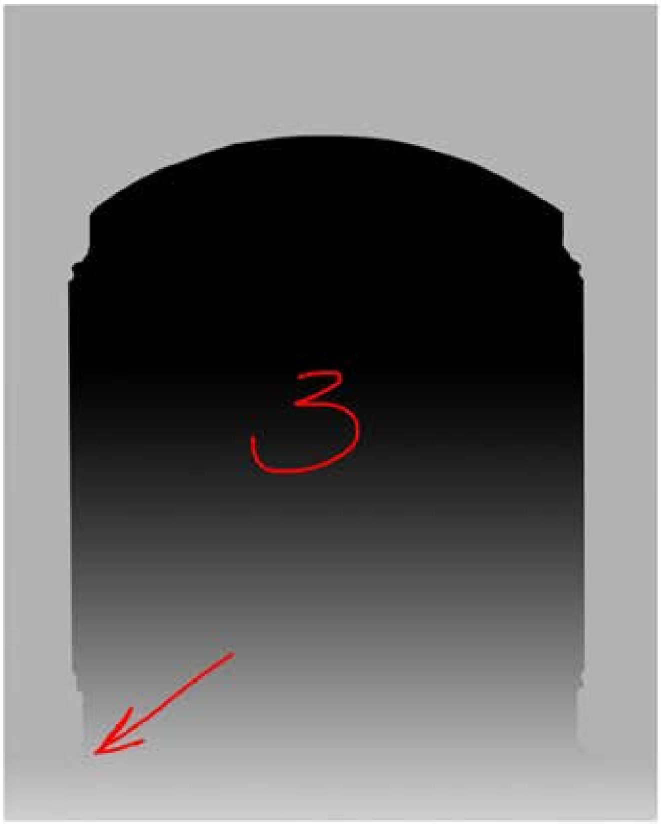


MAP DRAWING

On a new layer, with the transparent image below, draw the outline of the foreground arc with the 5 pixel red brush, select the inside of the path (make sure it is closed) and fill it with the Fill action. If you can use the graphics tablet, otherwise you can help yourself by holding down the Shift key to draw straight lines.

You could also get the same result with the Lasso selection, but I prefer to use the brush, because it's more visible.



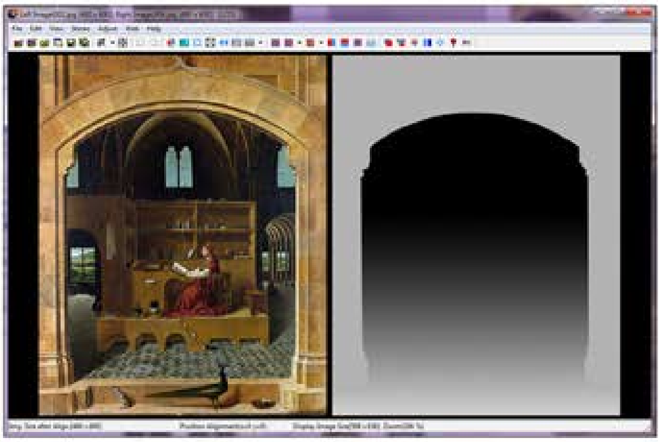


Now you have to replace the red with the gray of the depth map. But which gray?
Remember, at the same distance from the observer, the gray tone is the same. We find the right gray where the floor and arch meet, that is, at the base of the arch.
3. Pick the gray and fill in the red form.

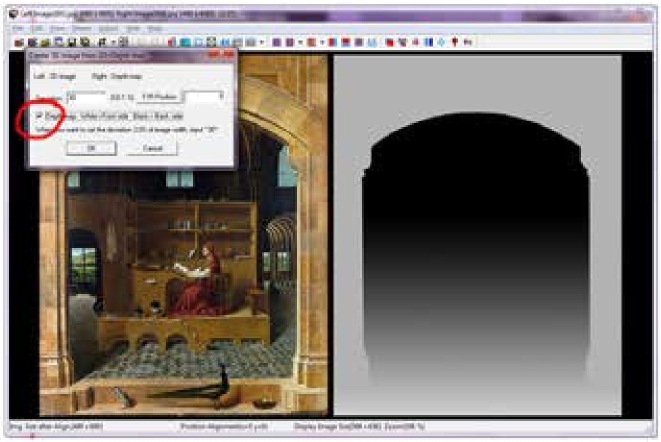
Once the level of the transparent image is off, the first draft of the map appears, with the black part at the top indicating the infinite, the nuance that is the floor and the uniform gray that is the arch. Enough to take a look at the result.

Open SPM and go back to PSH.

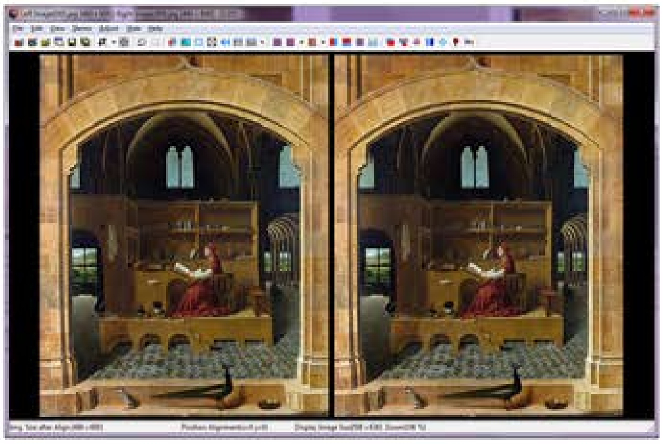
Save the gray image as Antonello_depth.jpg, open the directory directly from the bottom bar, activate Antonello.jpg and Antonello_depth.jpg and drag they onto the SPM icon, which will open the program showing the image and map side by side. So.

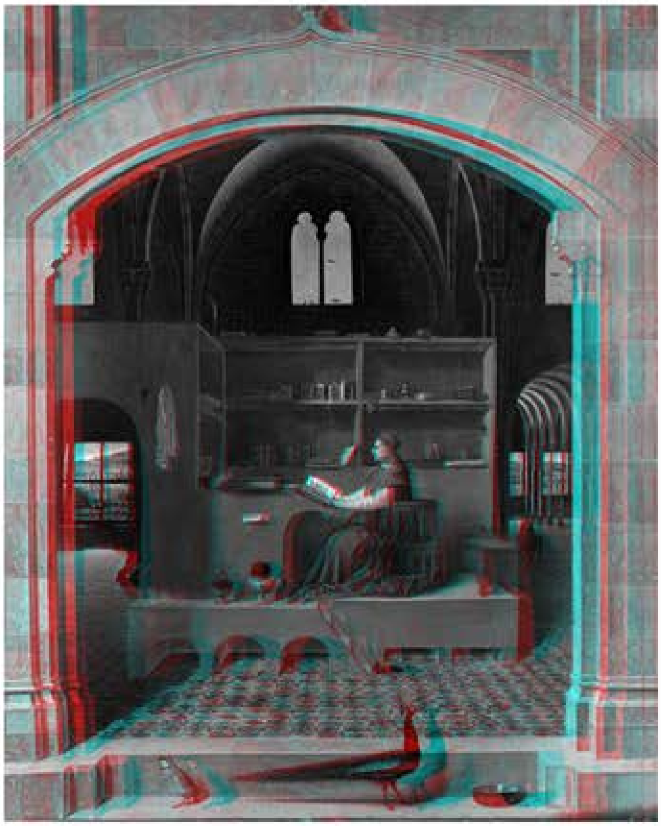


In SPM click ALT + D, a window will appear. For now, leave deviation 30, you will experiment after other values. But activate Depth map as in the image below.



In SPM click ALT + D, a window will appear. For now, leave deviation 30, you will experiment after other values. But activate Depth map as in the image below. Give OK and you will have a parallel side-by-side (below). If you don't see parallel click X and it becomes cross-eyed, with F6 and F7 it becomes anaglyph.

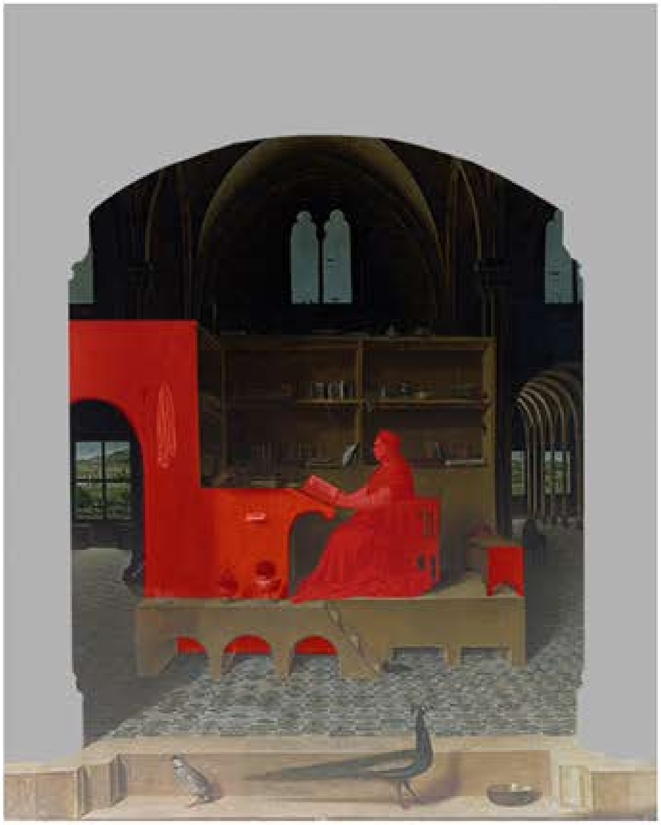




USE OF STEREOPHOTOMAKER

Let's get rid of the satisfaction and look at the anaglyph. With just 10 minutes of work are we already at this point? Yes, but the road is still long.

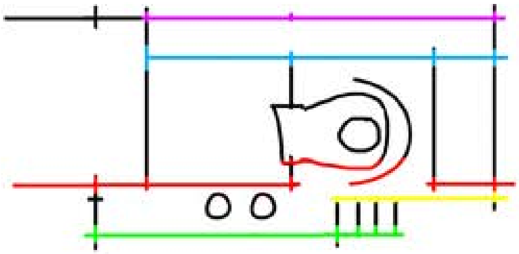
During the work, often save the _depth.jpg file and switch to SPM to check the result with the system just seen. Only if you are satisfied, also save the map as a PSD, otherwise cancel the last operations and try again.

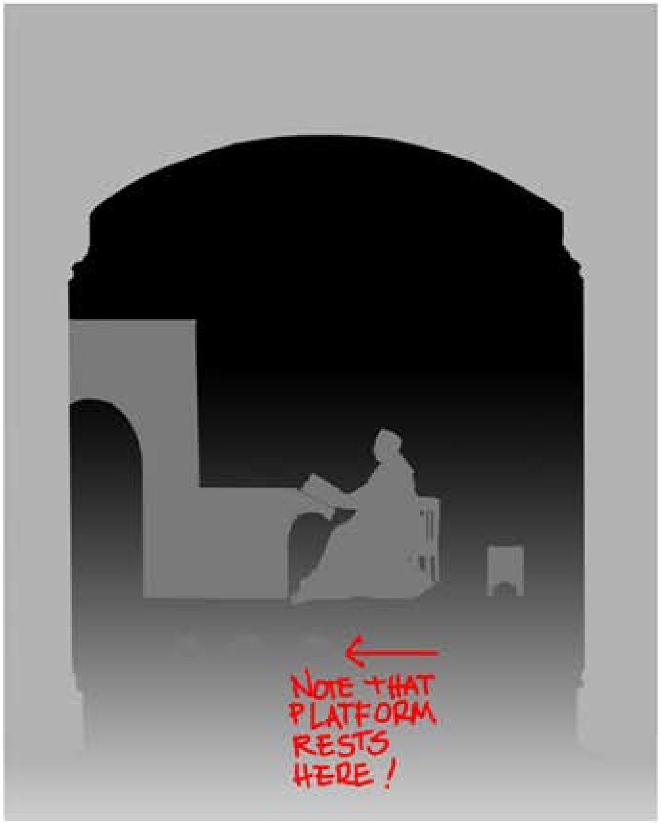


ORTHOGONAL SURFACES

Remember the (mental) map I mentioned earlier? Let's leave owls and peacocks in the foreground for now, and focus on point 4, the saint's platform, the main nucleus of the painting. What does it look like in plan?

We identify the surfaces perpendicular to the observer: there are five, which I have indicated in color.



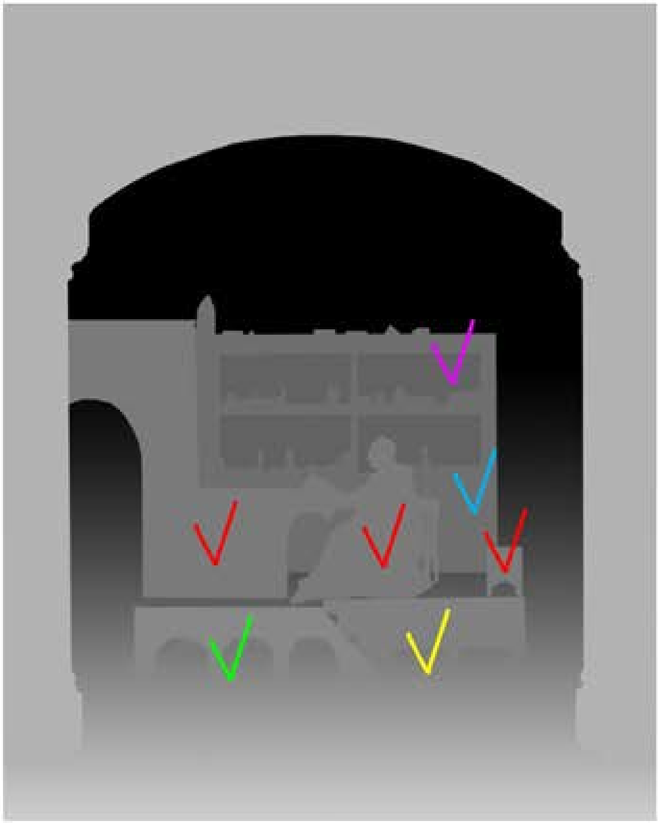

NOTE THAT PLATFORM RESTS HERE!

It doesn't matter in what order we work, but we start from the red surface, that is the edge of the desk with Saint Jerome and the chest.

We have seen how to do it: with the red brush, outline the areas that are at the same distance from you, then fill them with the same gray of the point where they rest on the floor.

One at a time (remember: in different levels!) repeat the operation with the other four surfaces.

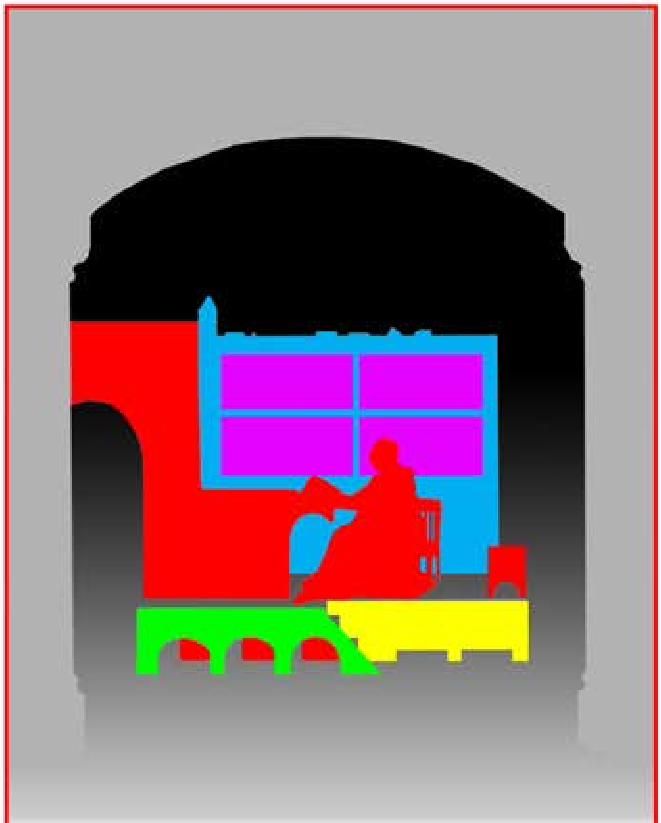
Each will be of a different gray tone that you will obtain with the dropper from the shade of the floor.
If the floor is covered, as in the case of the bookcase (magenta and cyan surfaces), imagine where they could rest.



This is the final map of the platform in five shades of gray, on which I have indicated the surfaces in the color of the plant (just to understand, you will not do it, of course).

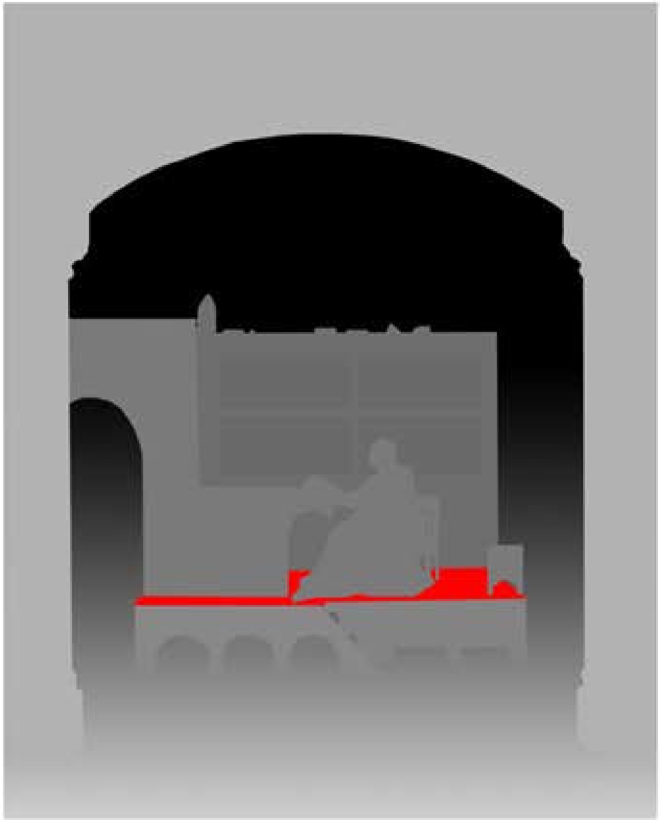
Now save the Jpeg and switch to SPM for rendering.

Wow!



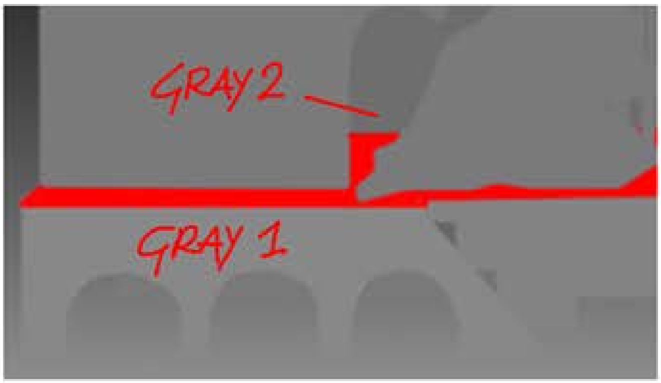
VARIANT

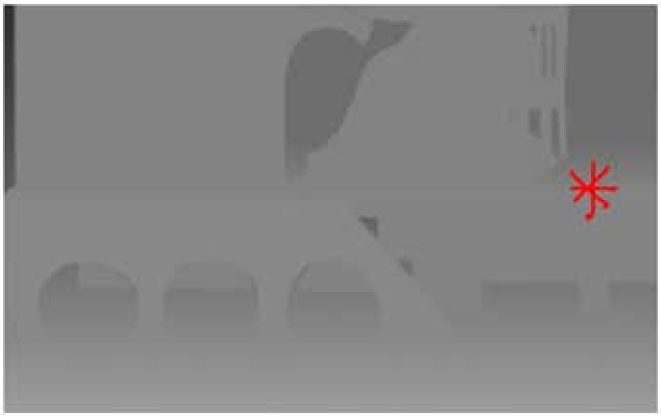
I don't recommend it to beginners and nervous people, because it's easy to confuse layers.
But if you are an expert in PSH you can speed up (even if not very much) the work by drawing first **all the areas** in different colors **on different layers** then to finally attribute the shade of gray detected with the dropper to each area.



We learned how to map flat surfaces perpendicular to the observer. Easy, because just detect the gray at the base of the front elements and fill the area with the same flat gray. But in the case of surfaces seen in perspective, whose sides have different distances from the observer?

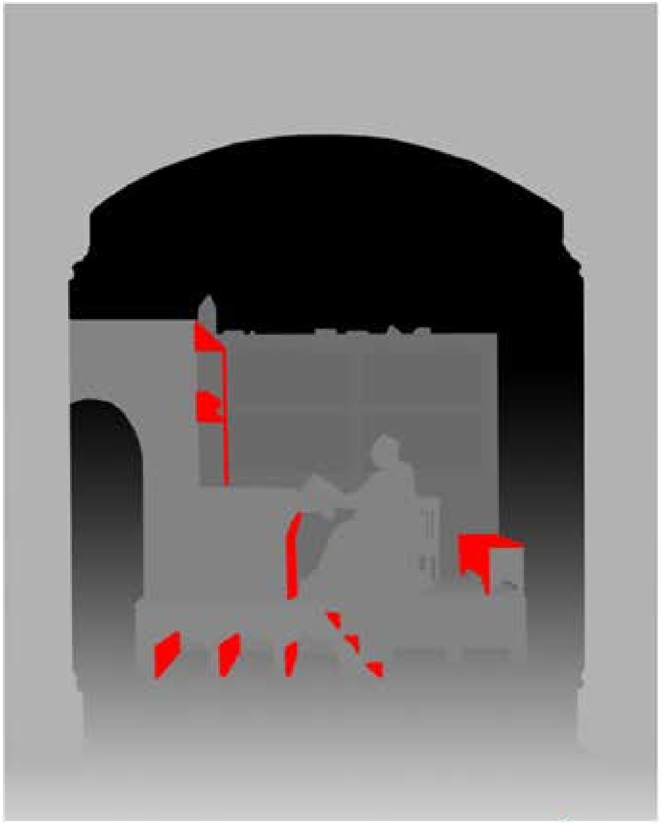
Let's take the platform pavement. It starts from the light gray of the ladder and reaches the darker gray of the bookcase. You got it?
Of course, just create a nuance that connects the two grays.





Here is the result. If you have used the right shades of gray in the vertical areas even in the falling area (therefore slightly darker than the foreground) marked by an asterisk, the grays must coincide.

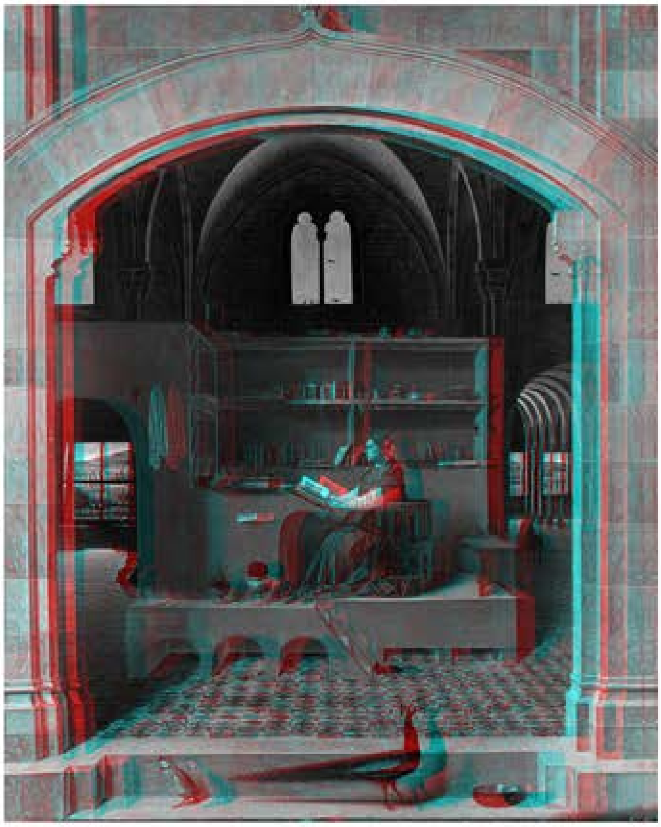
Continue with the same method on the other surfaces with the identical characteristic of being perpendicular to the observer. If you are not a perfectionist, forget about surfaces where the distance is minimal, such as the side interiors of the shelves.



After the structural part of the platform is finished, only the various wares surrounding the saint are missing: vases, books, unidentified non-flying objects. Compared to the scene they are shallow and so you just have to fill them with flat gray.

Do as I taught you: on new levels cut them out with a brush, fill them with color, select the gray where they rest and fill them with same gray.
So:

It's time to check the result.
Switch to SPM and render.



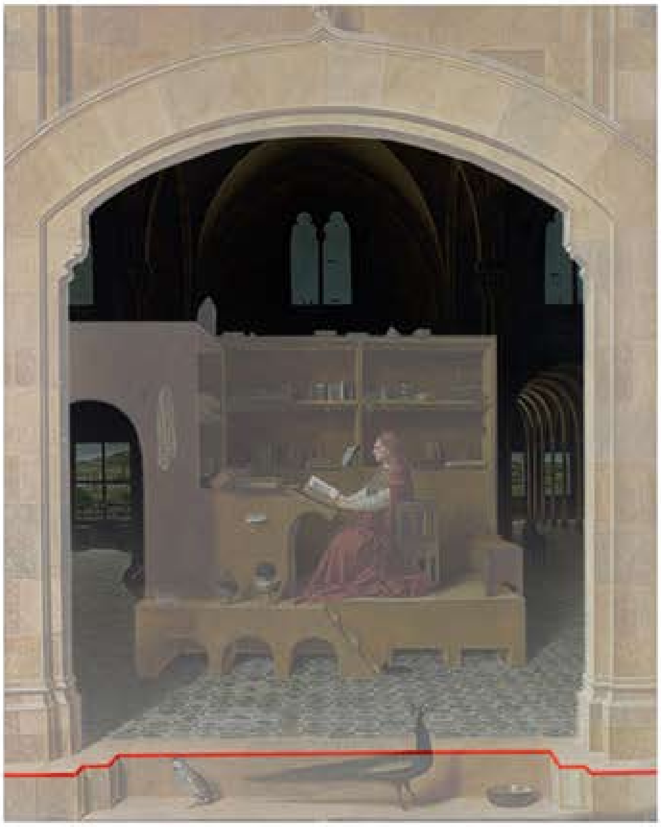
Seems almost done, doesn't it?

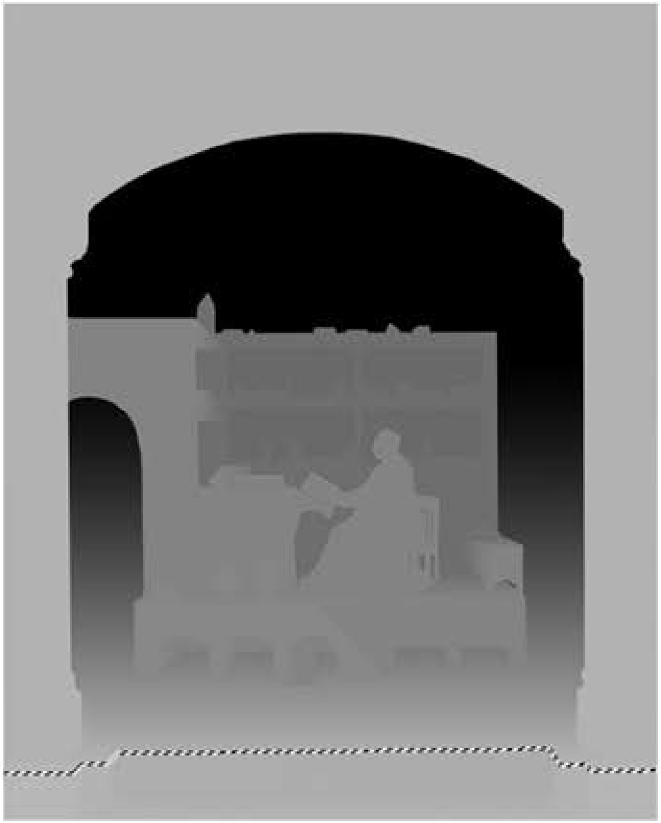
In fact, if we had kept the horizon line lower, at your eye level (see the previous pages), the scene behind the platform would not undergo parallax variations and would remain "flat". But we wanted to complicate things, damn it.

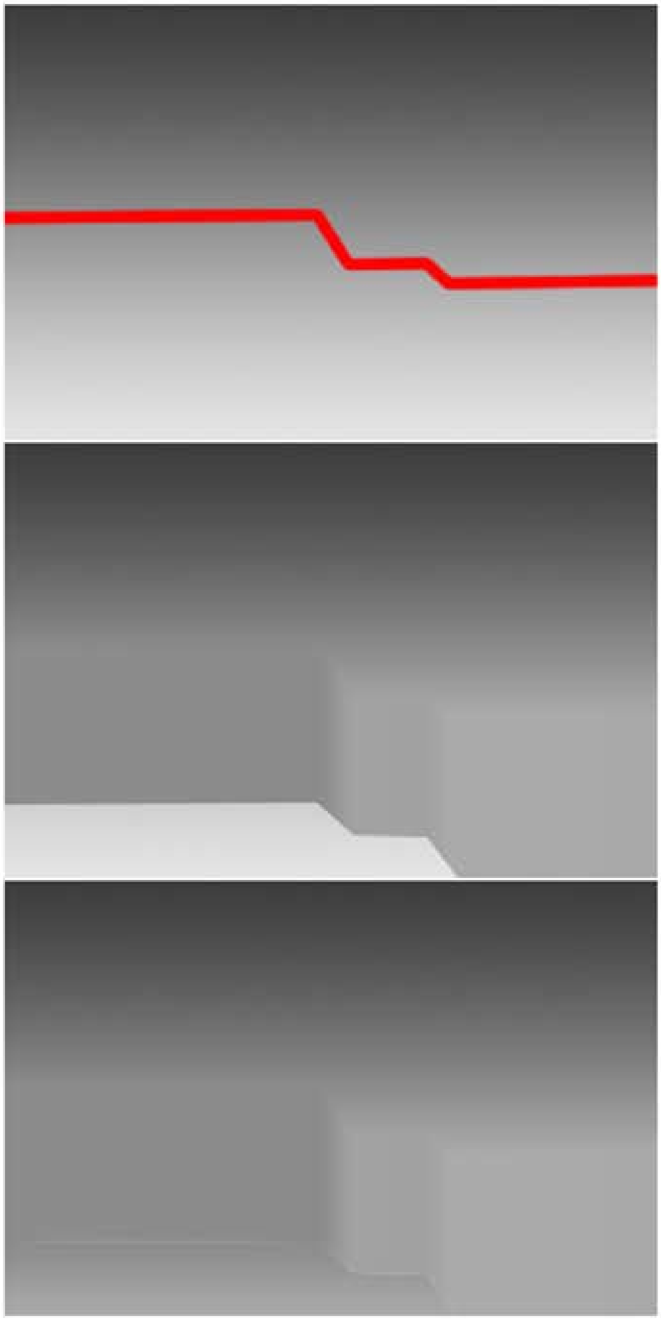
We had left the close-up, the step with the birds, incomplete. Let's do it now, because I'll teach you another trick, a refinement.

At some point the floor suddenly drops, it's just a step but it could be a waterfall. We take the usual red brush and draw the profile where the floor falls (on a new layer, of course).

We activate the line (Ctrl + click on the icon in the Layers window), delete the red line and copy the active part from the gradient layer. Then with Ctrl + Alt + down arrow we drag the nuance to cover the step.



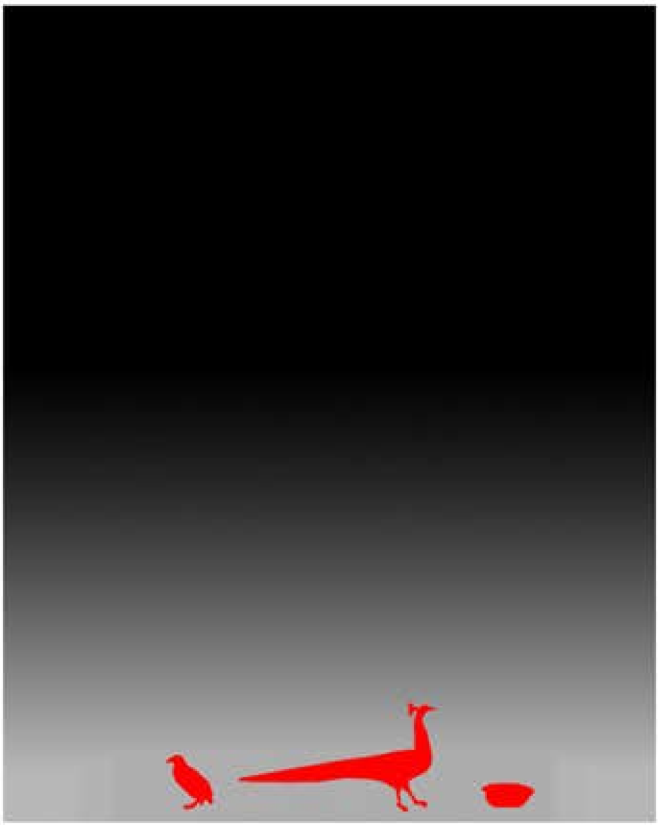


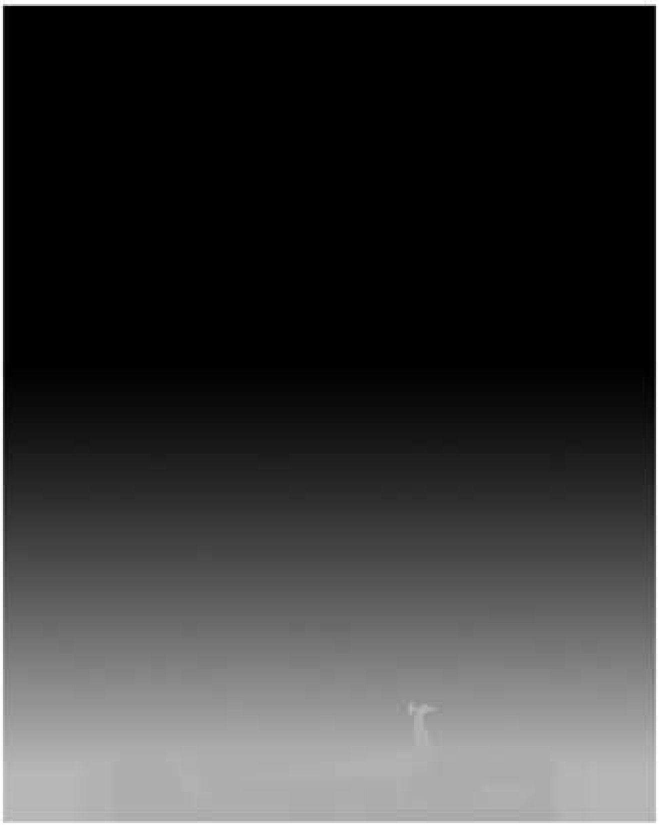


(In this picture the shades of gray are very similar, and to understand each other better, above I have enlarged and contrasted the detail).

Then select the floor at the base of the step and darken it by uniforming it to the step itself.

We continue with owl, peacock and bowl. But now you understand, don't you?

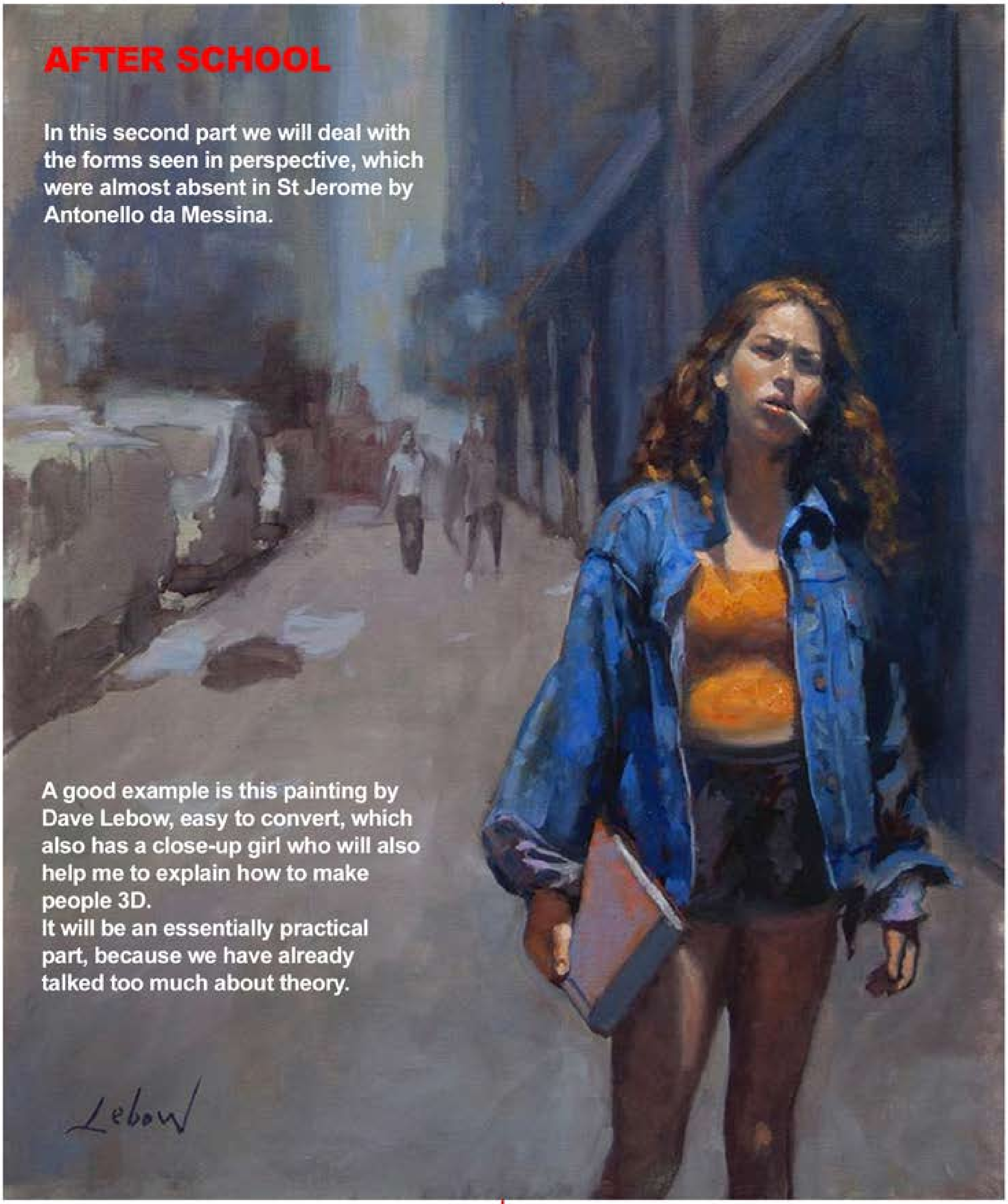




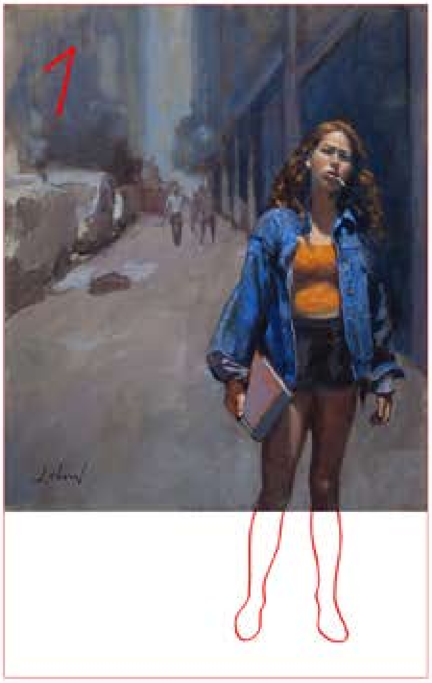
AFTER SCHOOL

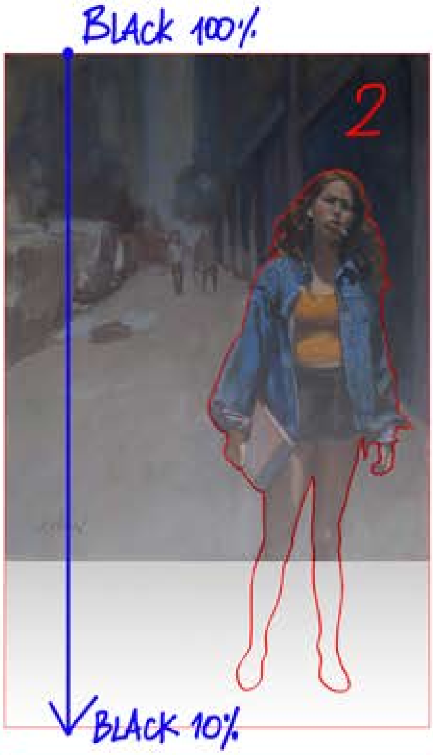
In this second part we will deal with the forms seen in perspective, which were almost absent in St Jerome by Antonello da Messina.

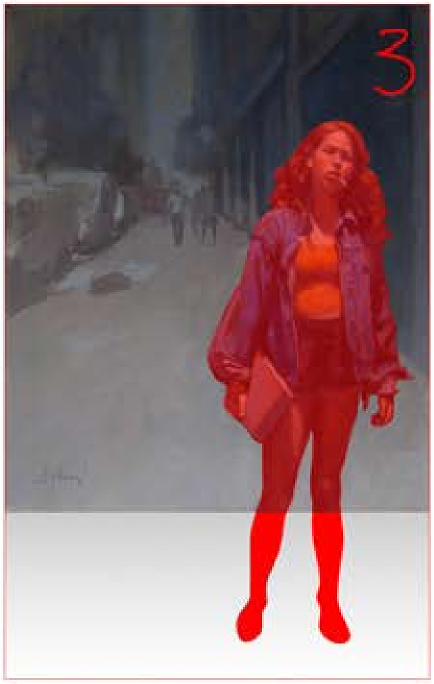
A good example is this painting by Dave Lebow, easy to convert, which also has a close-up girl who will also help me to explain how to make people 3D.
It will be an essentially practical part, because we have already talked too much about theory.



Dave Lebow, After School







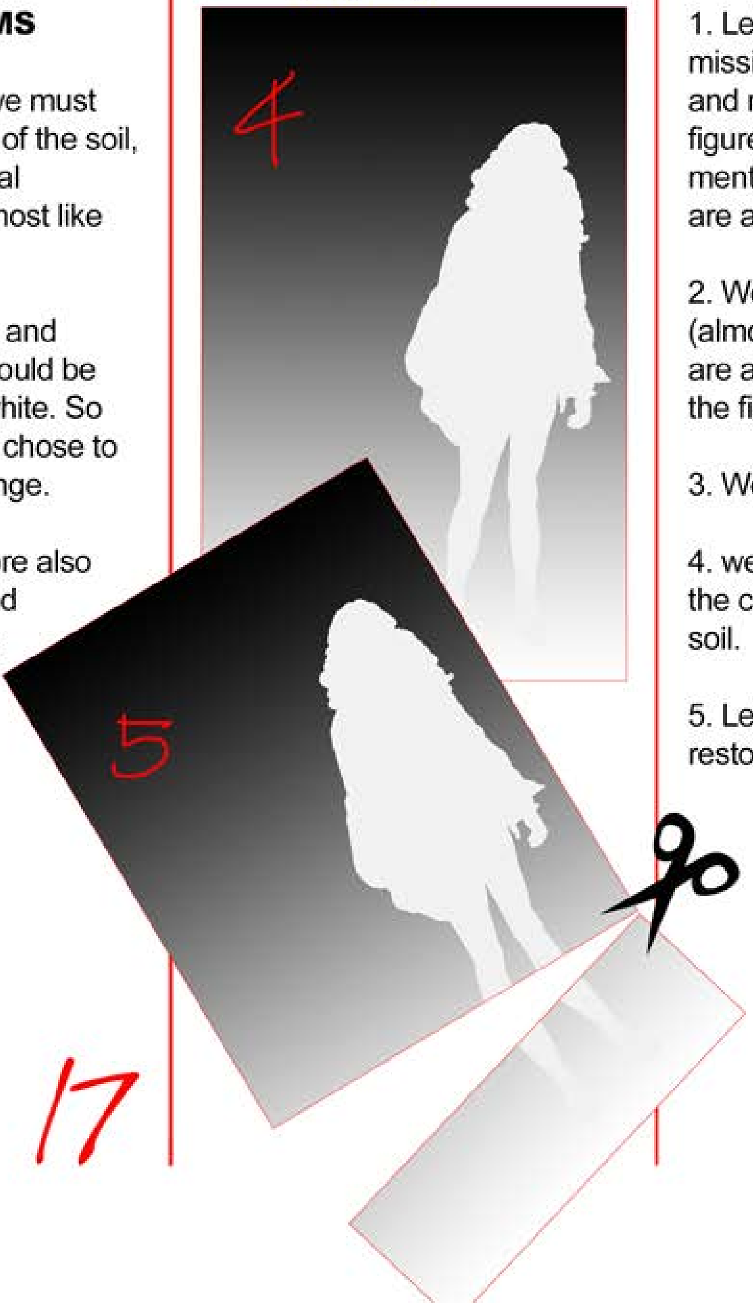
LIKE MUSHROOMS

We have seen how we must start with the nuance of the soil, and then make vertical elements appear (almost like mushrooms).

The girl is very close, and therefore her map should be very clear, (almost) white. So close that the painter chose to put her legs out of range.

We know that therefore also the point of the ground where they touch the shoes is (almost) white.

But where is this end point of the nuance?



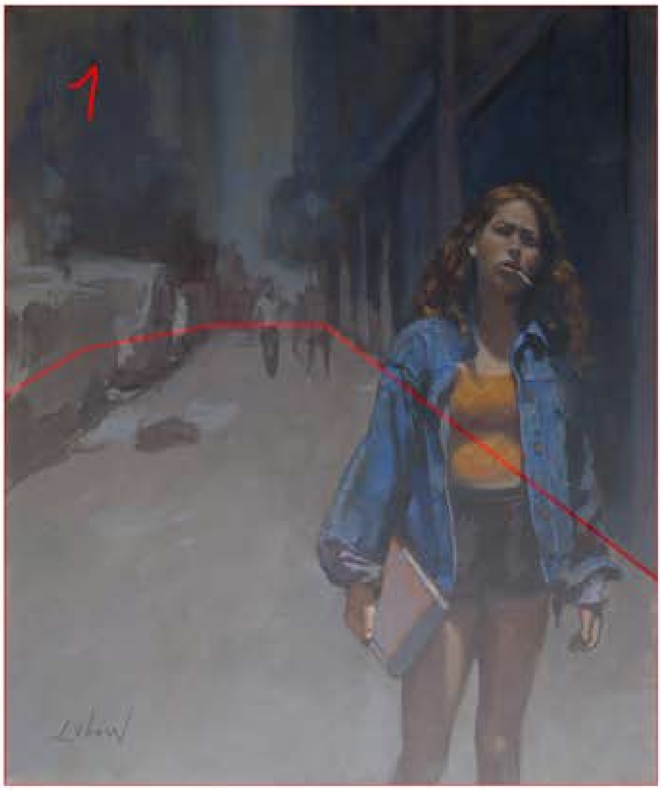
1. Let's find it by adding the missing space of the image and reconstructing the whole figure. Of course this can be a mental operation only, if you are an expert.

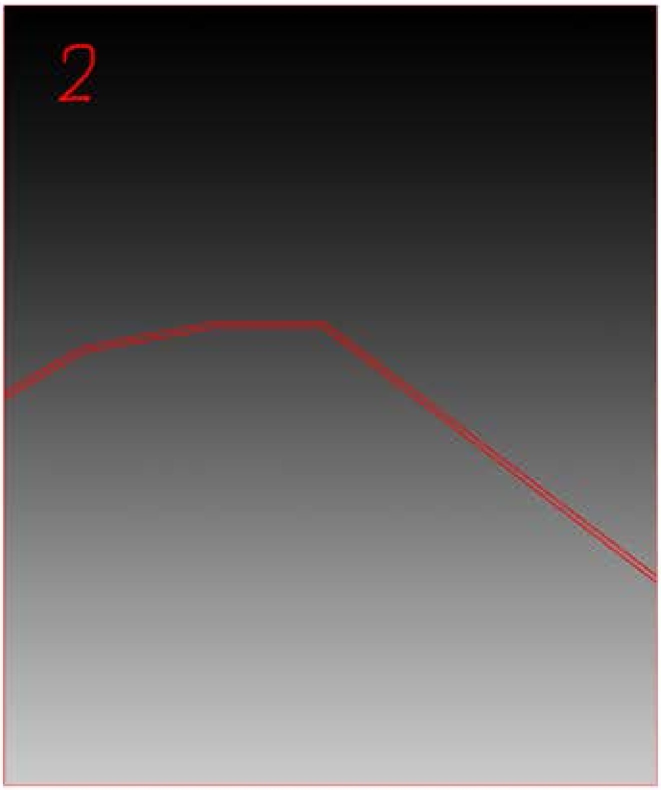
2. We fade from black to (almost) white and, while we are already there, we outline the figure as seen previously.

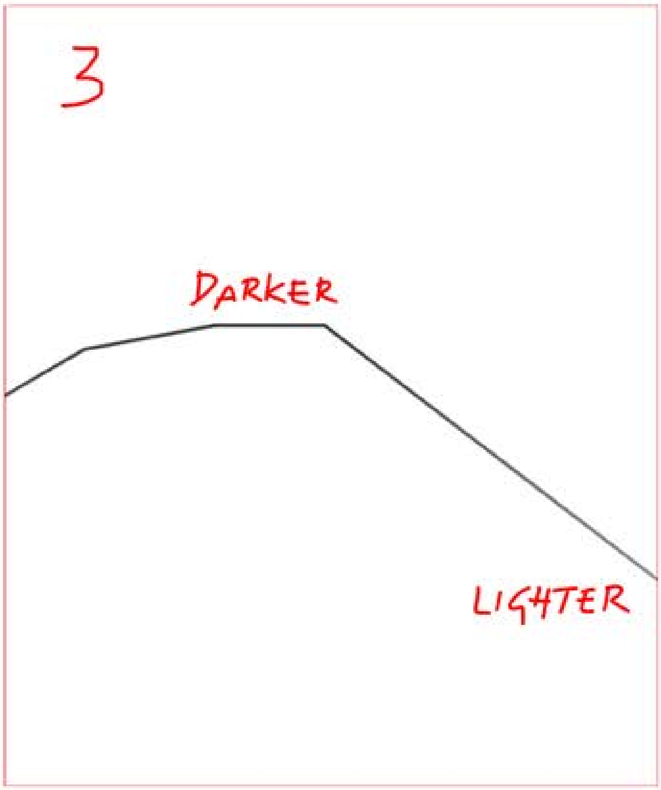
3. We fill with color and

4. we transform the color into the corresponding gray of the soil.

5. Let's cut ... the girl's legs and restore the original size.







PERSPECTIVES

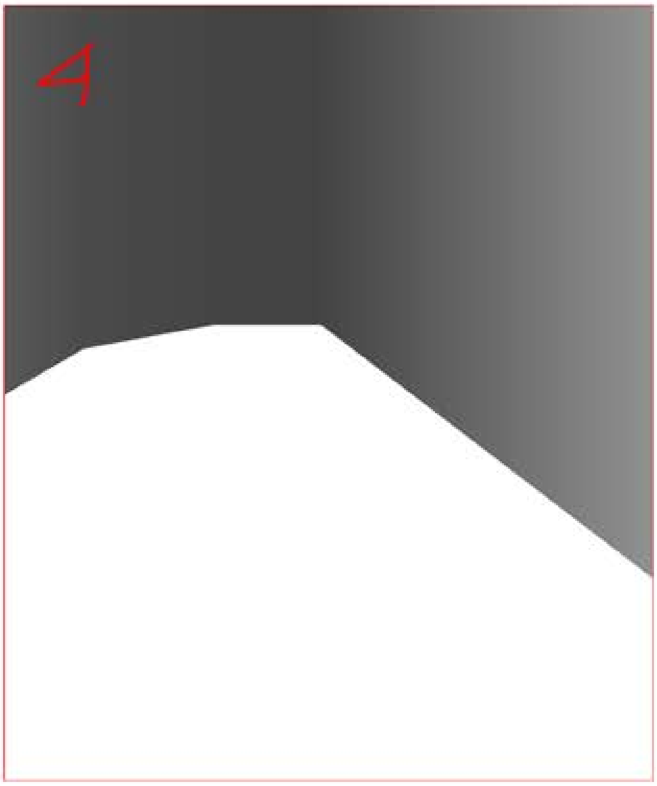
Now open your ears well, because you will use what I am going to show you in 90% of conversions. You know that where any object touches the ground, gray is identical. But if the gray has faded, how in this perspective?

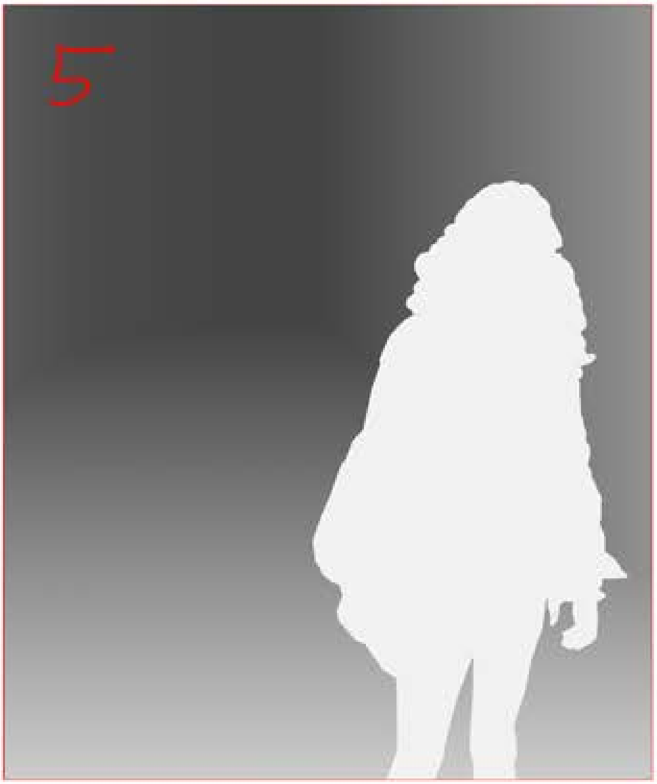
1. With the usual brush on a new layer draw a line at the base of the buildings.

2. Activate it. On the PC, keeping Ctrl pressed, I click the line icon in the Layers palette. Ants appear in PSH, I don't know in other programs.

3. Switch to the gradient layer of the terrain, click on any selection tool in the menu; the right mouse button will open a window: choose copy.

Now you have a line of various grays with the shape of the red line.

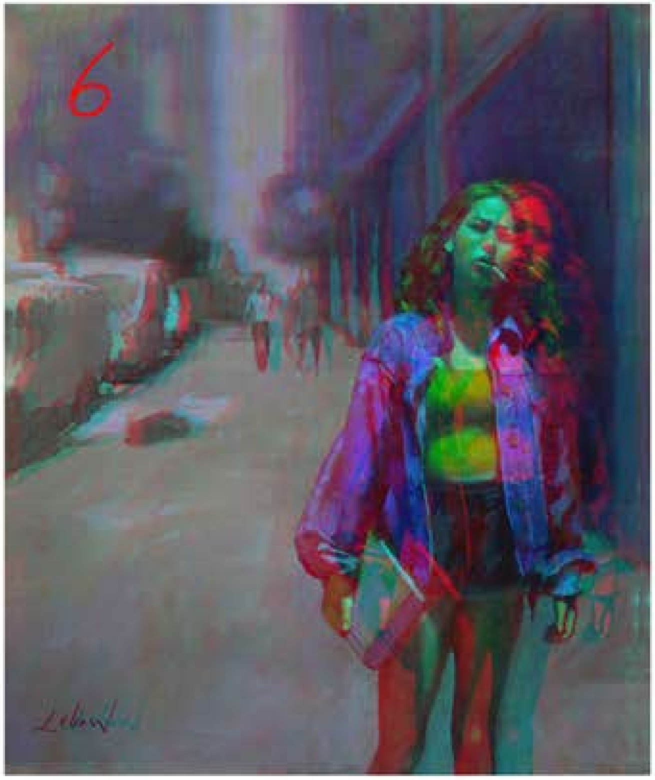




4. Again with Ctrl + click on the icon, activate the multi-gray line. Then, holding down Ctrl + Alt, drag the gray line with the Up arrow to cover the buildings. If it were exuberant, for example if it invades the sky, delete the superfluous.

5. Make the terrain and the figure of the girl visible. Save in Jpeg and upload the original and depth map in PSM. It's time for control.

6. Here is the anaglyph result. Some details are still missing and the girl, despite Lebow's skill, seems cut out of cardboard.



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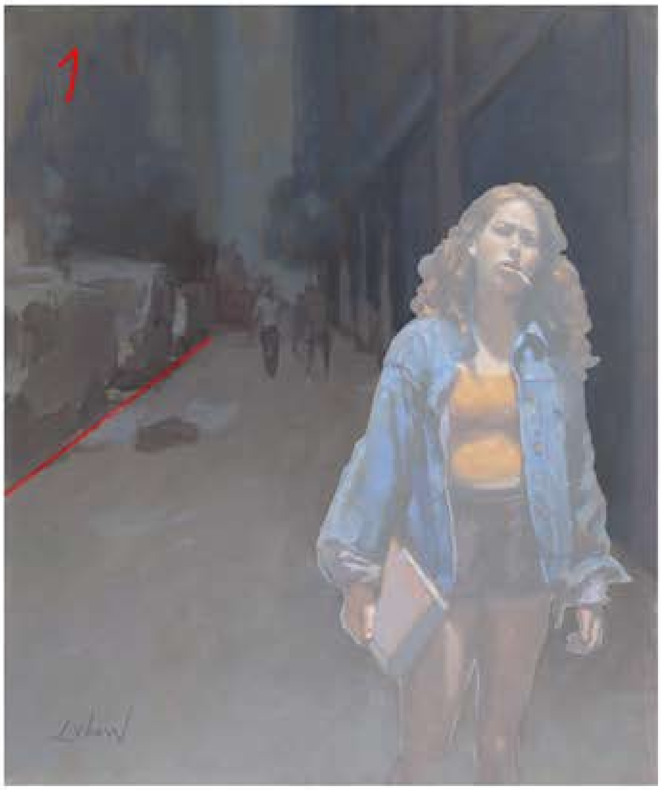

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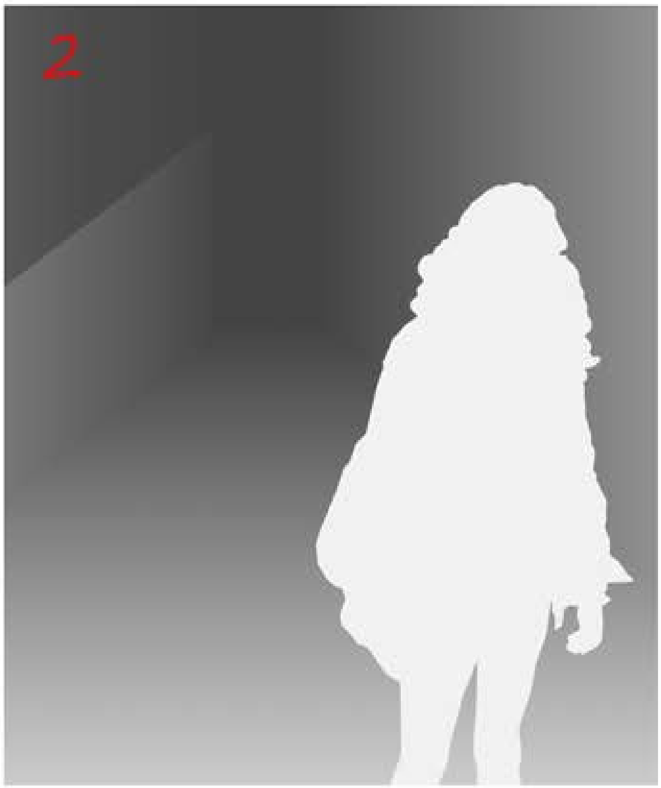

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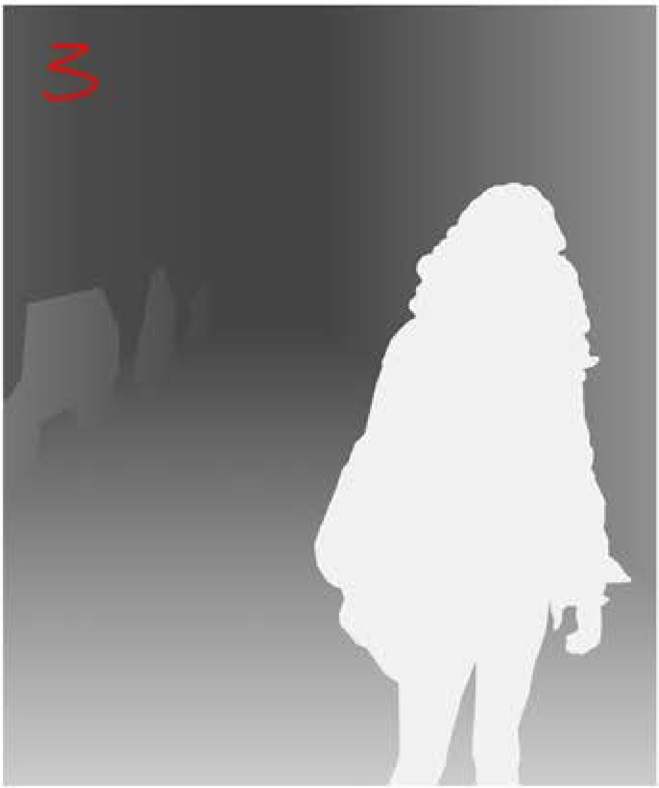

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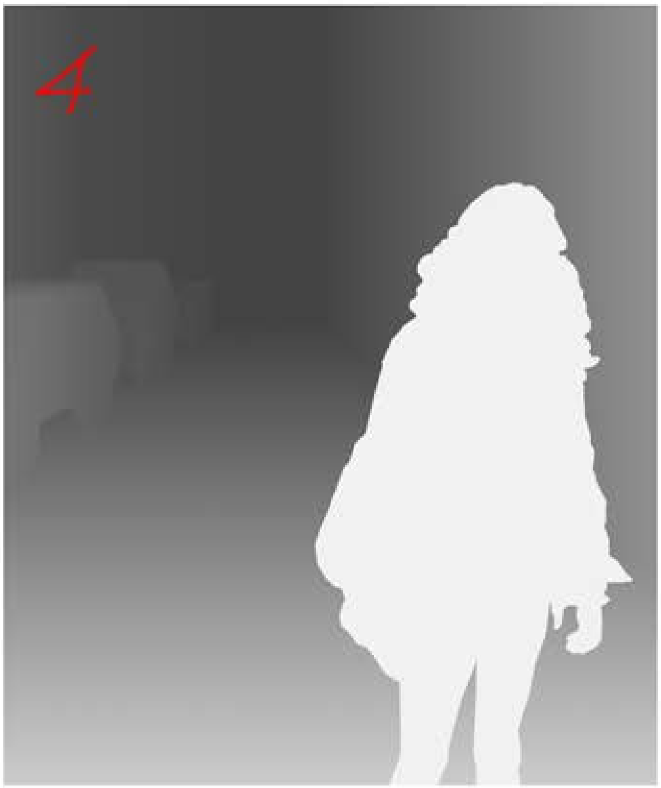


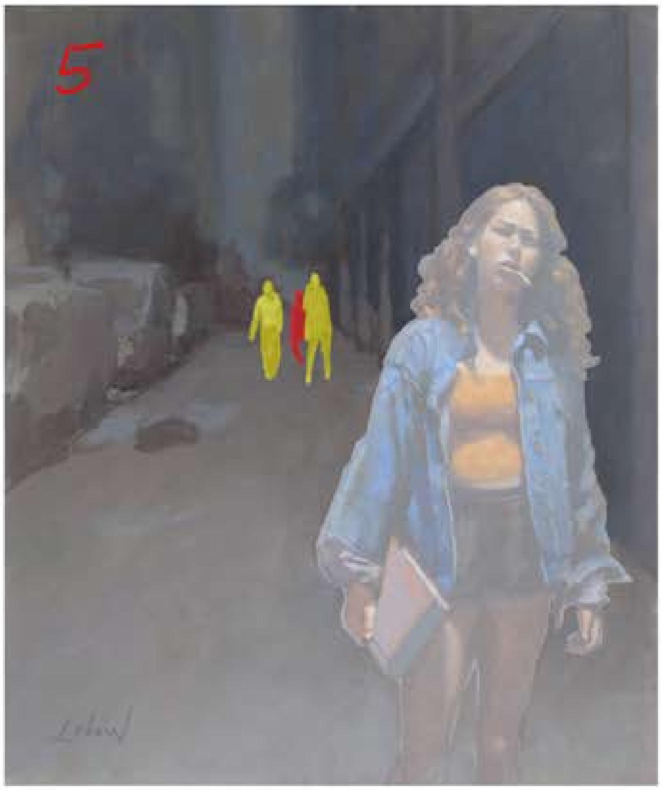
Let's move on to parked cars, which we will treat like buildings, so no news on what we already know.

1. Red line where they rest.

2. Transformation of the red line into a gray scale line and drag of it.

3. Cancellation of excess parts.

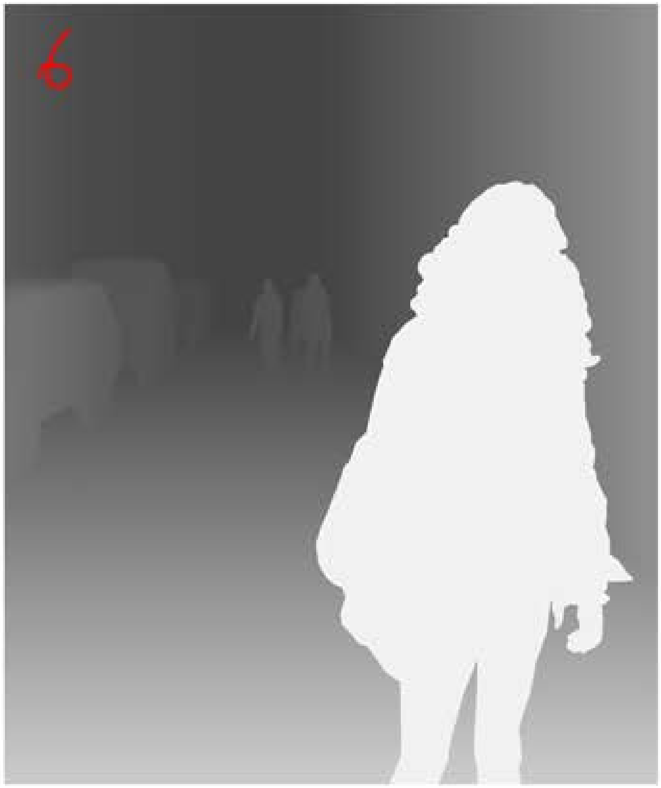
4. Completion of the car map, practically a horizontal drag of the gray sides.

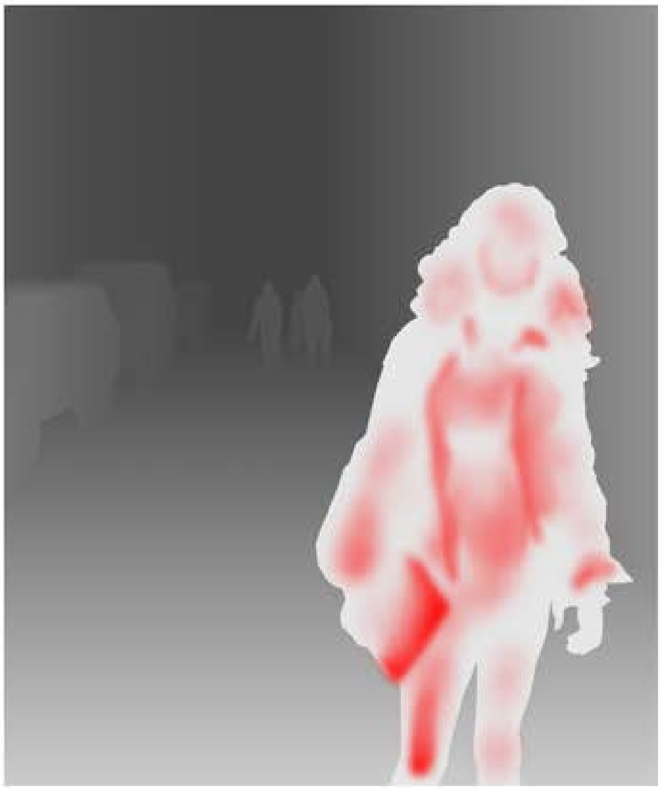


5. On different layers, we fill the three people in the background with color.

6. Here we are, with cars and people turned into depth maps.

I remember the opportunity to often make use of the rendering of SPM, the result of which is also a stimulus to move forward with the conversion.

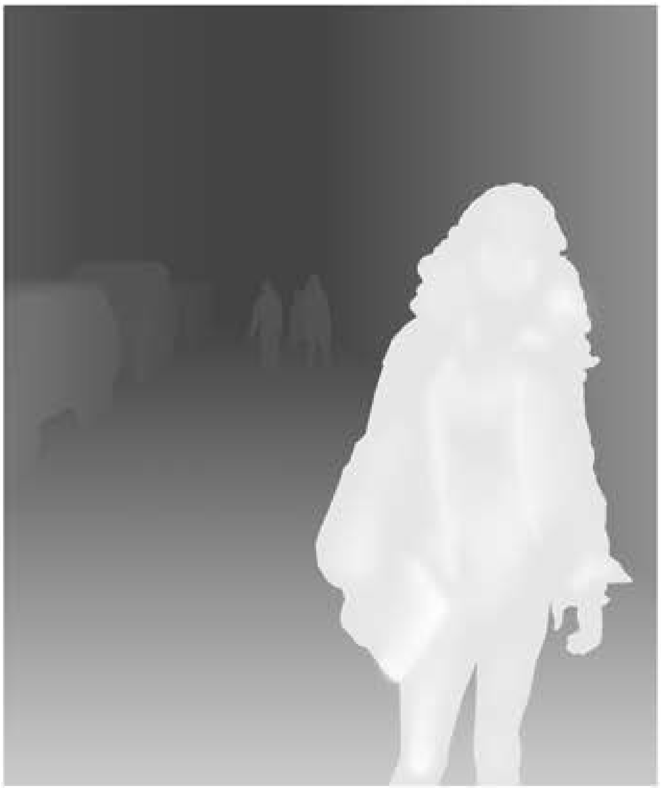




FIGURES

We come to a point where a tutorial is of little use, because much depends on the skill of the converter.
It is a matter of highlighting points in relief of a person with individual choices and, as in this case with book and cigarette, of "detaching" the elements from each other.

Since a standing human figure has very little depth, stay light. If you have a good eye, the variations of gray - minimal - can be made directly on the figure with a Lighten brush and shaded, or, as in the example, painted in red on a new layer, using shaded brushes and rubbers of various sizes and transparencies, which allows us to correct until we are satisfied.

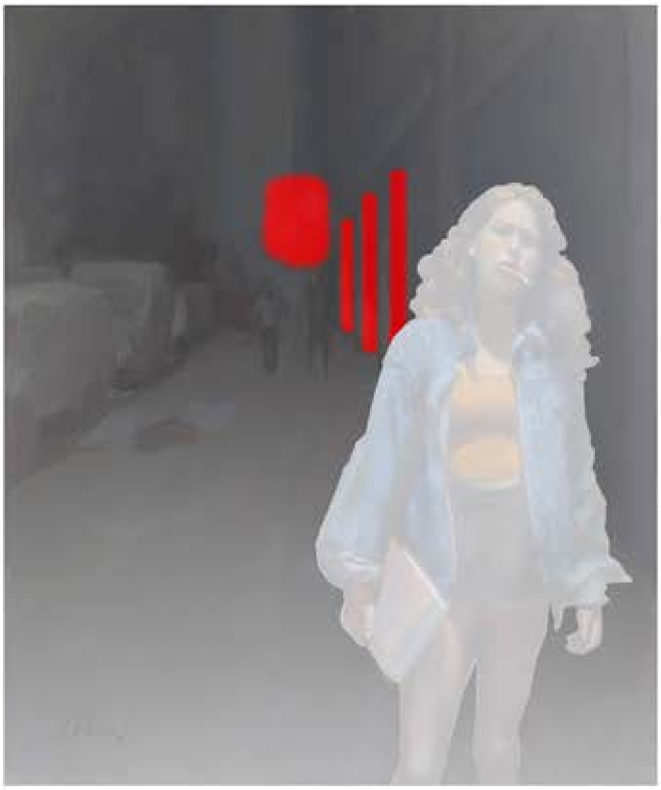


At this point you just have to turn the red to white and work on the transparency of the level.

Export map and image to SPM and render. You can do this several times until you get the result you wanted.

TIP

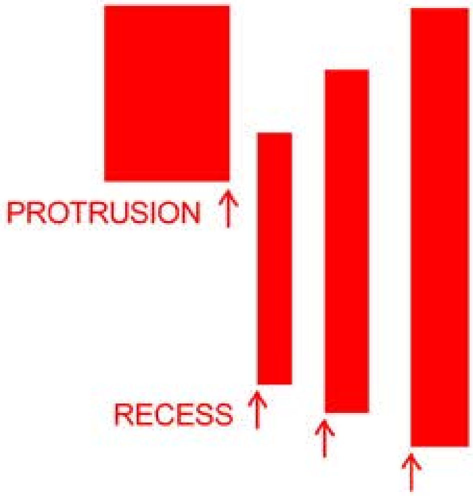
A word of advice: the attention is generally fixed above all on the face and the reliefs to be underlined are chin and nose.



PROTRUSION AND RECESS

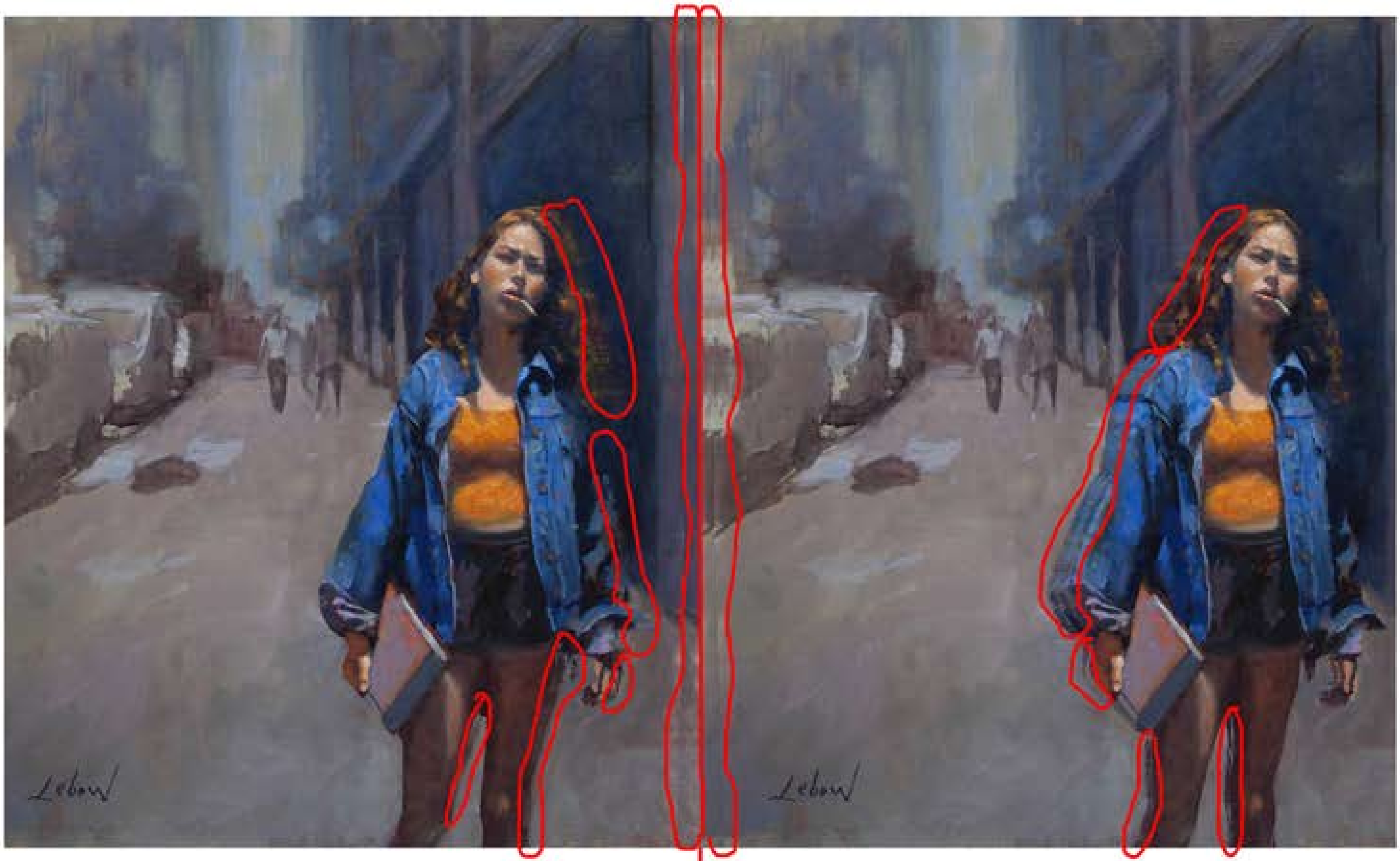
Last details, in this image almost imperceptible, but which you will often find in others: the indentations of the entrances to the building and the protruding signs.

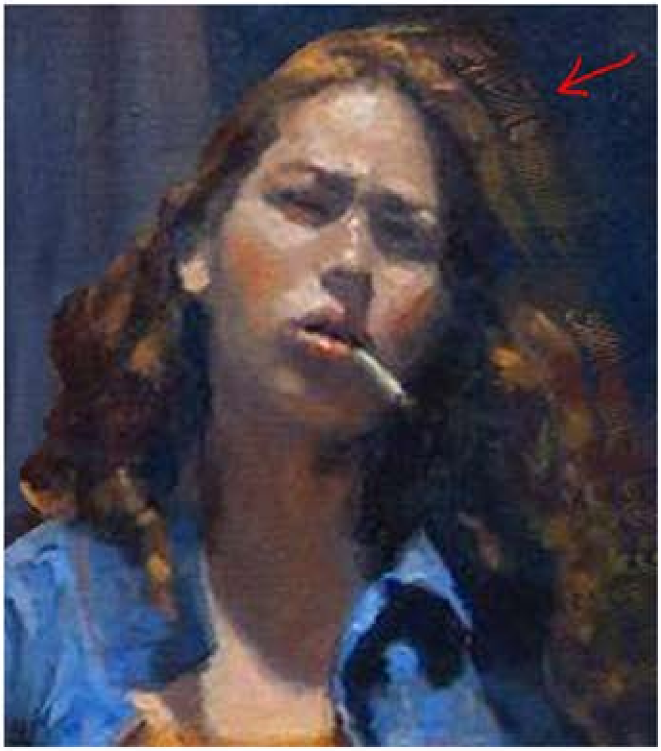
Usual red brush. Then, since they are perpendicular to the observer, they must be filled with uniform gray, which is picked at the point where they touch the wall: like this.

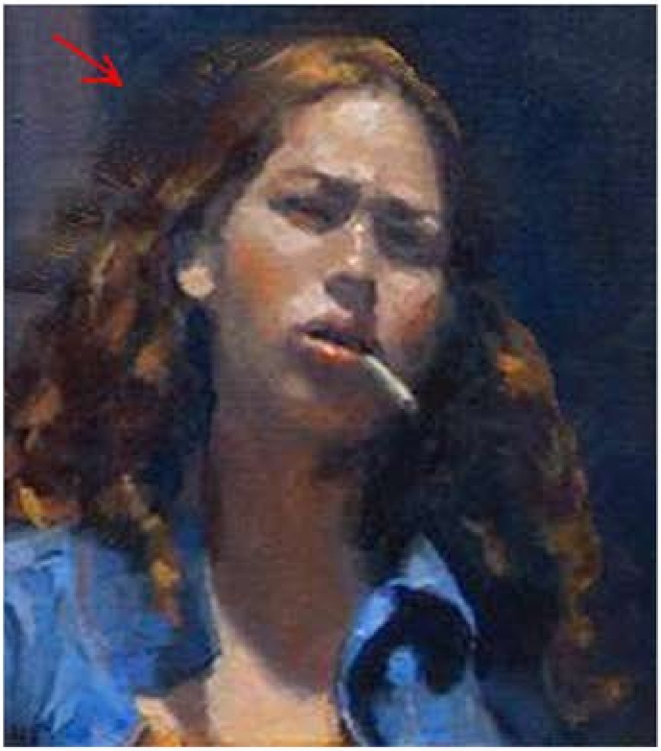


A jump in SPM for rendering.
Is that the final one? Yes, but there is still something to perfect.

Let's see what.







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WHAT'S BEHIND

With the depth map, the objects are moved according to the parallax, revealing the underlying part, hitherto hidden in the starting image.

Try rendering in sbs (side by side), with whether it is in cross or parallel view.

SPM often manages to "invent what's behind it" by dragging the pixels, but sometimes what I show on the left page happens.
(I purposely accentuated the defect to make it evident).

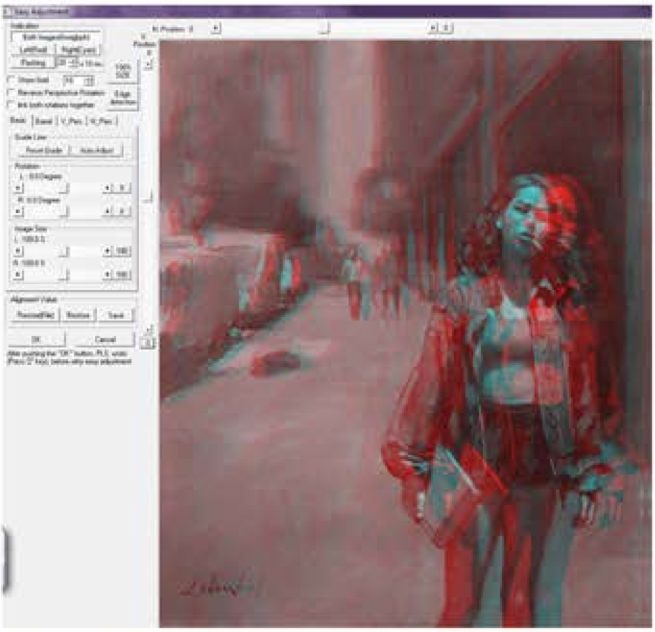
There is nothing to do but save the stereo pair and return to PSH.

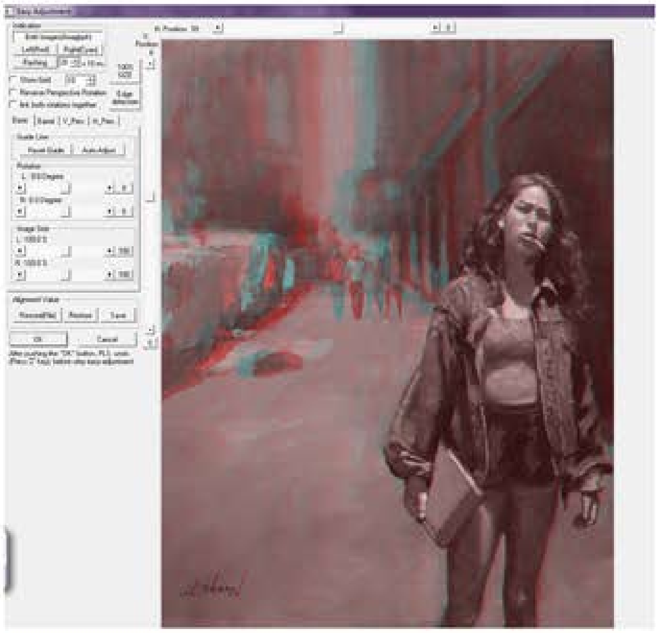
Now rebuild the parts revealed (badly) with brushes and stamp-clone. Leave the central parts that will probably be cut off. When you are satisfied, save with a new name and import the pair into SPM.

It's not over. In SPM, press the K button. You will enter the Easy Adjustment environment, which in this case has the purpose of avoiding the phenomenon called Window Violation, a phenomenon that 3D purists consider as a mortal sin.

Move the cursor up until the close up overlaps. You will notice that the side dirt has also been cut. Give OK and go back to the main screen.

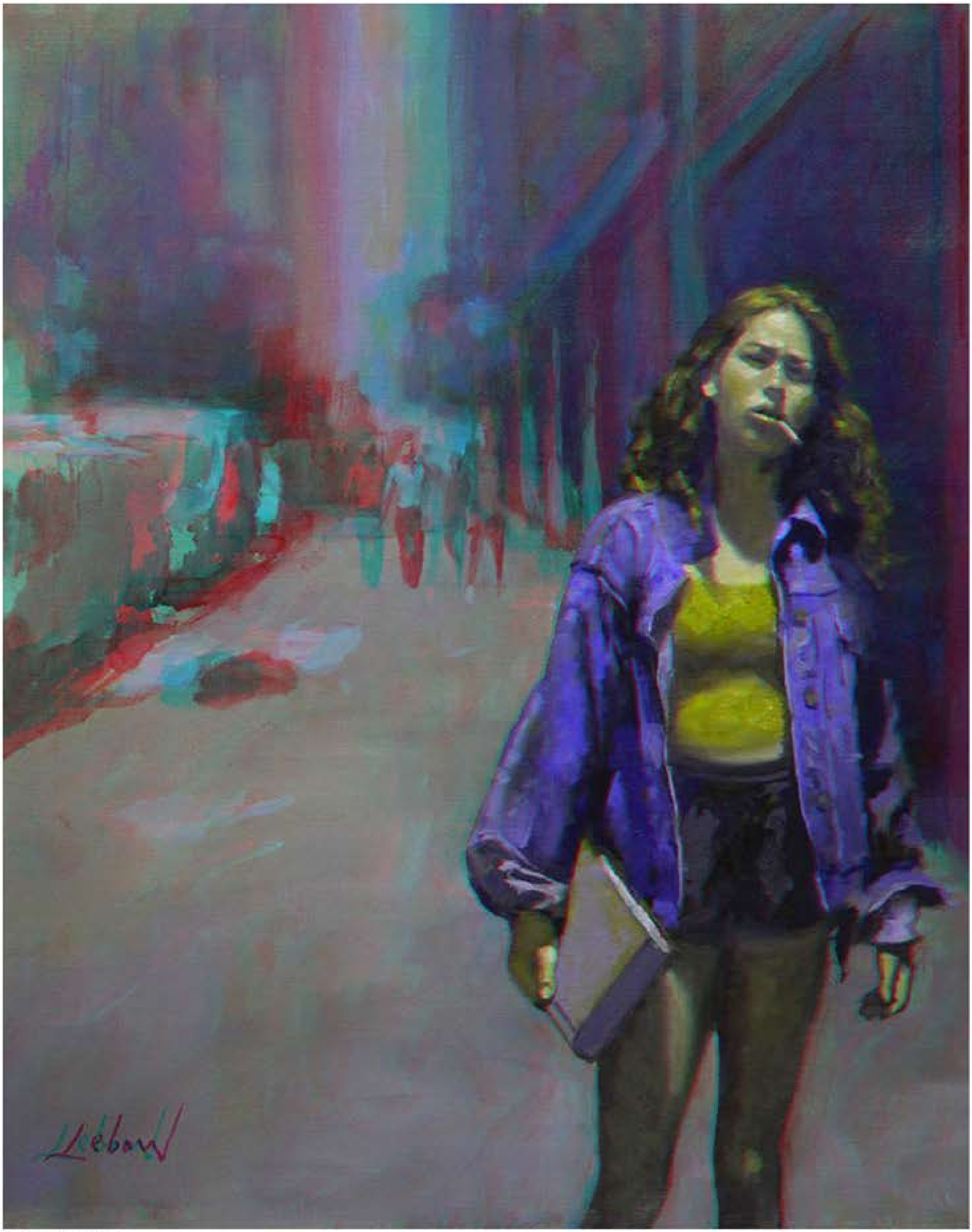
Finally it's done! With X you will have the opposite sbs, with F5 or F6 the anaglyph. After just one hour of work (this is the time for an easy conversion like this) you can save everything and go jogging.





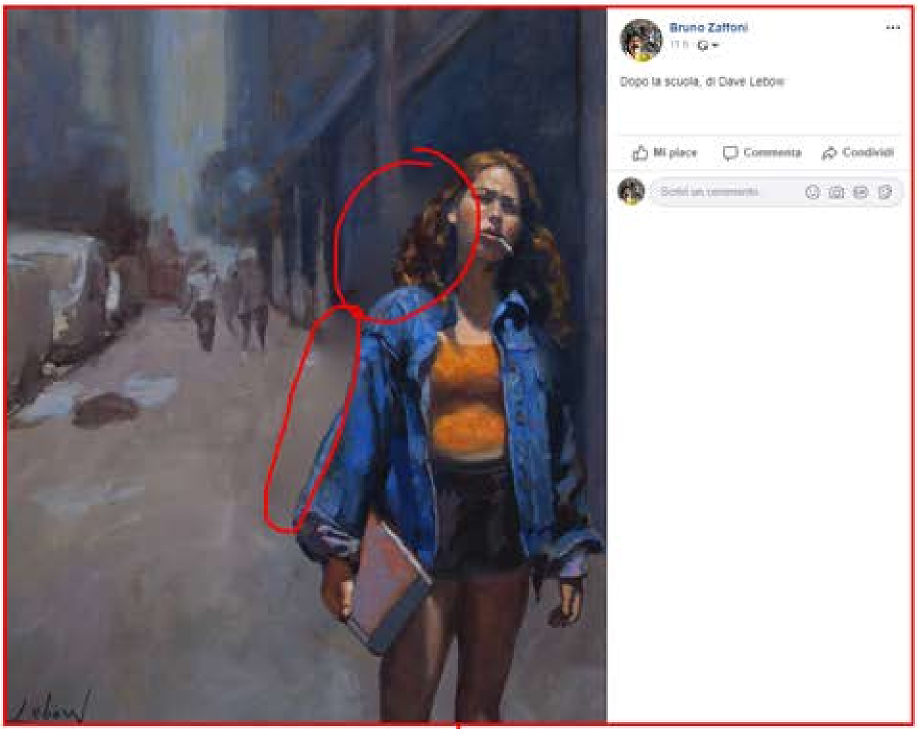
THE WINDOW VIOLATION

It occurs when the image appears to come out of the screen (the window).
It is allowed only if the offending object does not touch the frame (for example a flying bird or a punch whose owner is "inside" the window.



ANAGLYPH

CROSS EYED
PARALLEL



Dopo la scuola, di Dave Lebow

THE FACEBOOK 3D

The so-called 3D of Facebook deserves a separate discussion. It is not a 3D as the experts intend it, that is, it does not ask us to use the stereoscopic view that fortunately we have.

It is an algorithm made by Facebook that uses the map depth information to affect and move parallax.

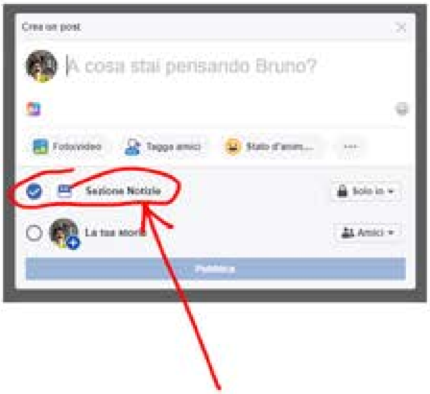
A bit as if a blind cyclops was traveling by train, with the mountain almost motionless, the countryside moving slowly, the faster houses and the trees in the foreground almost indistinguishable.

Not yet perfect, because not even FB knows what is hidden behind the parts revealed by the moving parallax, and in those areas it is forced to create a kind of fog, which is more or less annoying depending on the image loaded.

It is certainly a system that rewards those who convert, because it makes their work available to everyone. But it is also a source of despair, because the vision of a cross or parallel SDS is infinitely more engaging.

But how do you post a Facebook 3D?
At the beginning, if you remember, we saved the original image as Xyz.jpg and the map as Xyz_depth.jpg. It's just a matter of uploading them together in a group.

If, on the other hand, you want to upload the image and map to your profile, you must do it from the Home page and activate the News Section (I hope it is called so in English, because my fb is in Italian).



That's all, thanks to those who have had the patience to follow me so far.
Thanks to Dave Lebow who allowed me to use his artwork.
Thanks to Eytan Wronker and Franco Gengotti for stimulating me.
Ah, thanks also to Antonello da Messina.

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